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Railway Age

DAILY EDITION

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W.H.MINER CHICAGO

Alphabetical Index to Advertisements, Page 78

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Locomotive Lubricator Company

Booth No. 574, Atlantic City, N. J. 1202 Tower Bldg., Chicago, Illinois.

Railway Age

DAILY EDITION

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WE GUARANTEE that of this issue, 17,000 copies were printed; that of these 17,000 copies, 15,406 were mailed to regular paid subscribers to the Railway Age and the Railway Mechanical Engineer; 119 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, bound volumes, copies lost in the mail and office use, and 1,175 copies for distribution at Atlantic City.

THE RAILWAY AGE is a member of the Audit Bureau of Circulations (A. B. C.) and the Associated Business Papers. (A. B. P.)

A great deal of time is lost in the convention meetings by the reading of the reports in detail. This is, of course, necessary where the reports are sent out late and do not reach the members until just as they are leaving for Atlantic City. This year, however, the most of the reports were sent out several weeks in advance of the meetings and the members should have had plenty of time to read and digest those in which they were particularly interested. Indeed, many of the reports are so carefully prepared and go into such technical detail that it is hardly safe to attempt to discuss them unless they have been studied carefully in advance. While it may not be advisable to take such a radical step this year, some measure should be adopted to insure that the reports will be read only in abstract at the conventions next year. Secretary Hawthorne made a remarkable record this year in getting the reports out early and his staff is now so organized that it is safe to predict that even better results will be obtained next year. If this prediction is correct there is no reason why time should be wasted next year in reading the reports in full. It is an extremely difficult matter to get committee chairmen or the authors of individual papers to realize the importance or necessity of taking only a few minutes to place their reports before the convention. To check against this, the chairman should prepare their abstracts in advance and submit them to the General Committee to pass upon; or it might be advisable to have Secretary Hawthorne's office prepare such abstracts and submit them to the committee chairmen for approval. In this way prompt transaction of business would be insured and there would be more time available for discussion—and discussion from a practical and educational standpoint is one of the most important parts of the convention.

Stop Reading the Reports!

Too often committee work is more or less of a joke. Members of a committee are likely to place the entire responsibility of doing the work on the chairman, and sometimes the chairman finds it easier to rely upon his own organization to do the greater part of the work in compiling and preparing the report because of the difficulty of arranging for meetings of the committee. Secretary Hawthorne is helping to overcome the latter difficulty by arranging through his office for the meetings of the committees at the convenience of the chairmen, but taking the details of calling the members together off their hands. It is understood that a Committee on Committees has been appointed whose duty it will be carefully to study the make-up of each committee and see that it is composed of the kind of men who are specially well fitted to work on it. An example of how a committee should do its work is afforded by the present Train Brake and Signal Equipment Committee. Its meetings are noted for the fact that ordinarily 100 per cent of its members are present. All of the men on the committee are experts on the subject, and it is not unusual for them to sit in conference for more than a day; indeed, one conference laster several days, and all of the members worked hard and heartily during that time. With committees managed and made up in this way there is still another factor to be desired, and that is that the individual roads back up their representatives on committees and express a real pride in having them give the best that is in them to the committee work. The Pennsylvania Railroad has always insisted that its representatives on a committee make good, regardless of whether they were chairmen or members. More than this, it has placed its resources behind these men in the way of making special investigations or tests for the benefit of the committee. Other roads should adopt the same policy.

An Ideal Committee

Mr. Tyler's Tribute to the Railway Supply Men

MR. TYLER PAID A DESERVED TRIBUTE to railway supply men in his address to the Mechanical Section yesterday, which is published elsewhere in this issue. He said the fact that more progress has been made in the United States than in any other country in the development of railroad equipment is due largely to the railway equipment and supply manufacturers.

We believe it is not generally known that the railway equipment and supply manufacturers occupy a much more important place in the transportation industry of the United States than of any other country. In most other leading countries a large part, or even most, of the equipment and materials used by the railways is made in their own shops. For example, the British railways built most of their own locomotives and cars. There are big builders of locomotives and cars in Great Britain, but they get 90 per cent of their business from foreign countries. In this country, on the other hand, the railways buy almost all of their equipment and supplies from manufacturers.

The technical officers of the railways have invented many of the most important specialties and materials used. They have suggested improvements in many of those which have originated with the supply companies. They have designed a large part of the locomotives and cars which have been built. On the other side, the supply companies have bought and put on the market

many of the things which railway officers have invented and have co-operated with the railway officers in perfecting their designs, while, of course, they have made most of the devices and equipment which the railway officers have designed.

It has been chiefly this co-operation between the officers of the railways on the one side and the supply concerns on the other that has promoted the technical development of our railroads and enabled them to haul a ton of freight one mile cheaper than any other railways, while paying the highest wages paid by any railways.

While there has been this co-operation between the officers of the railways on the one side and the equipment and supply companies on the other, they have always had the relationship of buyer and seller. They, in consequence, have regarded themselves as being engaged in separate industries. As a matter of fact, however, in a broad way, the railroad business and the railway supply business are one big industry. It is not always even true that the railroad is the buyer and the supply company the seller since the supply companies are large shippers and in the relationship of carrier and shipper it is the railroad that is the seller and the supply company the buyer.

To say just how much the technical development of the railroads has been due to railway officers and how much to railway supply men would be impossible. But in view of the superior efficiency with which our railroads are operated, it may be safely said that the railway and railway supply men of the United States have both done their work better than those engaged in similar lines of work in any other country.

Locomotive Standardization

IN HIS ADDRESS at Monday's session Frank McManamy very ably presented the arguments for standardization. The great strides which have been made in industrial developments in this country have been made in an atmosphere of individual initiative which is the expression of the principle of freedom on which all our national institutions are founded. According to this principle, organizations as well as individuals should have the fullest possible latitude in the development of their own policies and ideas, only being restrained where it can be proved that the national interest demands the imposition of restraint.

The burden of proof, therefore, must lie with the exponents of general standardization. This has been done in the case of cars, which are universally offered in interchange, the question of standards therefore becoming a matter of general concern. On the other hand, while in special cases they may be used on foreign lines, locomotives are essentially a fixed part of the transportation machine, functioning to the greatest advantage when retained within the limits of the owning road, and to even better advantage when they are used exclusively on the home division. The fact that the extradorinary transportation conditions which were brought about by the war have made it expedient to transfer locomotives from one railroad to another does not alter this principle. Even the building up of permanent joint terminals in which locomotives of several roads are handled and dispatched by a common organization does not materially affect the situation, because these are largely turning points and the greater part of the actual repair work is cared for at terminals on the home road.

Standardization of locomotives has been adopted quite generally by individual railroads and where sufficient latitude is allowed in the working out and application of improvements, this is a highly desirable policy. But it is not safe to draw general conclusions from the facts in particular cases, and standardization should not be regarded as a principle, but as an expedient for the attainment of certain ends. These ends are uniformity of shop practice and tools, the reduction of the variety of repair parts and hence the number which must be carried in stock, and the reduction of first cost.

As it has been adopted by individual railroad systems, the first two of these ends have in a measure been attained. To apply a single set of standards to the nation, however, will add nothing to the benefits which are being derived from the standardization programs of individual roads.

These programs make possible uniformity in shops practically under normal conditions and reduce the material carrying charges as far as they can practically be reduced.

In fact, general standardization would be a backward step, so far as the attainment of these benefits is concerned, for a period of 15 or 20 years. The standard locomotives already built have added to the number of classes and non-interchangeable details, now too large in many cases, which the more progressive railroads are endeavoring to reduce. To offset the disadvantage of this long transition period there must be assurance of large benefits in the end in addition to those now already assured from the measure of standardization which has developed naturally under private ownership and operation.

Of the advantages claimed for standardization the only one which offers reasonable hope of fulfillment is that of reduced first cost, which may be secured through ecenomies in construction made possible by quantity production. This, however, is not large, owing to the comparatively small number of engines to be built of a single standard type and is a question of minor importance as compared with the question of the preservation of individual initiative and incentive in the development and improvement of motive power. It is not difficult to form an opinion of the effect on the state of motive power development 20 years hence, if the actual application and working out of new ideas and improvements must pass through the hands of a central organization for approval or rejection by a comparison of the motive power of 20 years ago with that of today. And yet 15 or 20 years must elapse before a general standardization program will have become effective.

The statement that standardization does not mean stagnation is true within certain limits where it has naturally developed and has taken a form expressive of the ideas of close knit organizations. In few cases have standards been so rigidly maintained that improvements were not very readily incorporated, not only in new designs, but in the old power. The attempt to maintain universal standards of necessity must greatly increase the difficulty of securing the adoption of improvements to prevent a rapid growth of local changes which would soon destroy the standards. The inflexibility and unwieldiness of such a central organization will effectively kill the incentive to continue the rapid pace which developments of the past twenty years have taken.

There is still much to be done before the locomotive is sufficiently perfected to attempt to maintain fixed designs. Take the question of fuel economy which is only just beginning to receive serious attention in this country. It involves the consideration of many problems of boiler and firebox design. The present high cost of fuel and the necessity for conserving the nation's fuel resources demand the utmost freedom in the development of improvements and in themselves are a sufficient reason for not adopting a program of national standardization.

Program For To-day

9.30 A. M. TO 1.30 P. M.

Discussion of Reports on: Fuel Economy and Smoke Prevention	9.30 A. M. to 10.00 A.M.
Specifications and Tests Materials (M. M.)	10.00 A. M. to 10.30 A. M.
Design and Maintenance of Locomotive Boilers	10.30 A. M. to 11.00 A. M.
Locomotive Headlights	11.00 A. M. to 11.30 A. M.
Superheater Locomotives	11.30 A. M. to 12.00 A. M.
Individual Paper on Carbonization in Valve Chambers and Cylinders of Superheated Steam Locomotives; Its Cause, Effect on Lubrication and Maintenance, and Proper Measures to Overcome Same, by F. P. Roesch	12.00 A. M. to 12.30 P. M.
Amalgamation of other Mechanical Associations with Section III—Mechanical of the American Railroad Association	12.30 P. M. to 1.00 P. M.
Questions Proposed by Members	1.00 P. M. to 1.30 P. M.

ENTERTAINMENT

10.30 A. M.—Orchestral Concert. Entrance Hall, Million Dollar Pier. Fry Philharmonic Orchestra.

3.30 P. M.—Band Concert and Impromptu Dancing. Entrance Hall, Million Dollar Pier. Royal Scotch Highlanders' Band. Tea will be served at 4.30 P. M. in Entrance Hall.

9.30 P. M.—Mardi Gras Dance. Ball Room, Million Dollar Pier. Royal Scotch Highlanders' Band.

The Mardi Gras To-night

THE BALL ROOM on the Million Dollar Pier will be the scene to-night of a merry affair. It will be termed a Mardi Gras dance and will be in its nature somewhat similar to the carnival dance of last Thursday night. The Highlanders' band will furnish the music for a twenty dance program and during the intermission the members of the Entertainment Committee will distribute paper caps, streamers, horns, squakers, confetti, etc. Fun will then reign supreme till long after midmidnight.

Lost and Found

LOST—Badge No. 4187 by Mrs. S. F. Armstrong and Badge No. 184 by George Akans. If found, please return to *Railway Age* booth.

LOST—R. S. M. A. Badge No. 2312 by J. N. Gallagher of the O'Malley-Beare Valve Company. Finder please leave at the *Railway Age* booth.

FOUND—Badge No. 5349. Apply to Secretary Conway's office.

LOST—Parasol, blue with Roman border, tan stick with fork handle. Return to E. W. Winchester, Logan Hotel, or Secretary Conway's office.

FOUND—Small fur neckpiece. Call at Secretary Conway's office.

Yesterday's Entertainment

THE ENTERTAINMENT FEATURES of yesterday and last night were greatly enjoyed. In the morning a band concert was given in the ball room of the Pier, and in the afternoon an orchestral concert received a generous attendance. The afternoon affair was followed by an informal dance during which tea was served.

In the evening the announced informal ball was thoroughly enjoyed, and there was a large attendance, although many convention people attended an added attraction in the Hippodrome. Sixteen dances composed the evening's program. The committee in charge consisted of Langley Ingraham, Chairman, assisted by J. L. Paxton, H. E. Passmore, J. C. C. Holding, Ellsworth Haring, F. T. Connor and R. J. Himmelright.

A Big Convention

REGISTRATION BOOK NO. 4, which will be issued to-day, will show some astonishing attendance figures. We have talked about the year 1911 as a record-breaker. It was and has continued to hold this distinction until this year. Book No. 4 will show a total attendance of 5,771. It is safe to say this morning that over 6,000 people have attended the conventions up to this time. The comparative figures between 1916 (up to Sunday evening) and 1919 (up to Monday noon) are as follows:

	1916	1919
Members	628	630
Special guests	511	1,795
Railroad ladies	417	600
Supply ladies	305	450
Supply men	1,453	2,246
Foreign guests	....	50
Total	3,315	5,771

The figure for the "members" needs some explanation. In former years many members registered for both the M. M. and the M. C. B. conventions and were counted twice. This, of course, is not being done this year.

American Society for Testing Materials

THE TWENTY-SECOND ANNUAL MEETING of the American Society for Testing Materials will be held at the Hotel Traymore, beginning today and closing Friday, June 27. The program for today's sessions is as follows:

FIRST SESSION, 10 A. M.

Minutes of twenty-first annual meeting.
Annual report of Executive Committee.
Report of Committee E-6, on Papers and Publications.
Report of Committee D-3, on Method of Sampling and Analysis of Coal.
Report of Committee E-4, on Magnification Scales for Micrographs.
Announcement of election of officers.
Miscellaneous business.
M. O. Leighton, chairman of the National Service Committee of the Engineering Council, will address the meeting on the activities of that committee.

SECOND SESSION, 3 P. M. ON PRESERVATIVE COATINGS, LUBRICANTS AND CONTAINERS.

Report of Committee D-1, on Preservative Coatings for Structural Materials.
Paint, a Plastic Material and Not a Viscous Liquid.
Report of Committe D-2, on Lubricants.
A Viscosimeter for Gasolene.
Report of Committee D-10, on Shipping Containers. Motion pictures will be presented showing certain activities of the United States Forest Products Laboratory, Madison, Wis.

THIRD SESSION, 8 P. M., PRESIDENTIAL ADDRESS AND MEMORIAL SESSION.

Annual address by the President, Guilliam H. Clamer, on the subject of Standardization.
Memorial session in honor of Dr. Edgar Marburg, late secreary-treasurer of the society.

President Walker, of the R. S. M. A., has extended the full privileges of the Million Dollar Pier to the members of the American Society for Testing Materials during the remainder of the convention of the American Railroad Association, Section III, Mechanical. The badges of the members of the Testing Material Society will admit them to the Pier at any time.

Train Line Connector to be Investigated by Mechanical Section

DURING LAST THURSDAY'S SESSION the subject of automatic train pipe connectors was brought up, under the head of Questions Proposed by the Members, by C. E. Fuller, superintendent motive power and machinery, Union Pacific. The discussion, which follows, was referred to in an editorial which appeared in the June 20 issue of the *Daily Railway Age:*

Mr. Fuller: Sooner or later we may be confronted with automatic steam and air hose couplings. I have noticed one on the pier. I do not remember whose it is, but it looked pretty good to me, and I think this association ought to study the subject, because I am sure we are going to be confronted with an automatic coupler sooner or later and we ought to anticipate it.

Wm. H. Mussey (Long Island): We have had a good many years' experience with automatic connectors and I think we ought to consider very carefully before we go into it. We have come to the conclusion that the straight automatic connector has so many difficulties involved in it that it involves the coupler question.

F. W. Brazier (New York Central): We have a train on one of our divisions running between Highbridge and Yonkers, a short distance, which has been equipped for about eighteen years with automatic connectors, but train has been kept going on the run back and forth without being broken up and they have been very successful. We are using one manufactured by the Westinghouse Company. This question was very much debated by this association a few years ago. We had committee reports on the subject, but the movement has died down. There is a movement on foot now to make tests, and go into it deeper, and it would be a good idea if this matter were referred to the Train Brake and Signal Equipment Committee. There are a number of different designs, and on the Lines West, Mr. Thompson can tell you they are testing out some on his trains.

W. O. Thompson (N. Y. Central Lines): We are trying out some of these connections on the lines West of Buffalo, but we are not in a position now to give any definite information, for the reason that we have put the equipment on our suburban trains and there is no cutting apart and switching or anything of that kind with those trains. We have now changed the couplers on some branch line trains that will be cut apart and switched around and perhaps that will give us a chance to give you a little more information later.

J. J. Tatum (U. S. R. A.): We have been working with connectors. All of us have realized for a number of years that the connector is going to come into use some day, and I believe we ought to get into position by having a committee follow up the development of the connectors so we will know more about them when they are developed than we know about the draft gear. You would be surprised to know how little we know about draft gears. It would be a good move by the association to have a committee follow up the development of the connector so that when it is complete and ready for use, they will be able to tell us something about it that we can bank on.

J. McMullen (Erie): We have a suburban train equipped with an automatic connector. I happened to be at Jersey City a few days ago when I was coming down here and I noticed this train come in on the platform while I was there and it seemed to be working very nicely. There was a car connected on the end of this train that was not equipped. This was done by the use of a dummy which they have in connection with the connector that we are using, and gives satisfaction.

Mr. Mussey: I didn't want to be understood as saying that the automatic connector did not have a lot of very good features, but the difficulty on one of the points Mr. McMullen has just brought out is the question of coupling other cars, and the attachment of the coupling is so closely allied to the couplers that it is really almost a part of the coupler, or should be, and the subject might be sent to a sub-committee of the Coupler Committee.

Mr. Fuller: We have been using automatic connectors for a long time. I had an experience in 1902 and 1903 on the Alton, with varied results. There is no question but that we have got to come to it and this association should be in touch with anything that is being done.

The Chairman: These men who have remarked that they have some in service on their trains that are never broken up must realize that there is absolutely no advantage in an automatic coupler if that is the service you are going to put it in. The argument has always been that the absolute need for them, if there is one, is for use in suburban trains, where you are breaking your trains up and slamming them together. I suggest if anybody is going to use automatic connectors that they put them in service where the trains are broken up and not where the benefits of the automatic coupler cannot be fully realized. The real test is in the suburban service, where you have a great deal of crossover conditions and conditions which are severe, but actual working conditions, as a rule.

On motion, the subject was referred to the General Committee, to be assigned to a new committee or to one of the standing committees.

Message From General Atterbury

IT WAS EXPECTED that General Atterbury would be present to take part in the "Recognition Program" last Saturday evening. President Walker of the R. S. M. A. received the following telegram from him on Saturday morning:

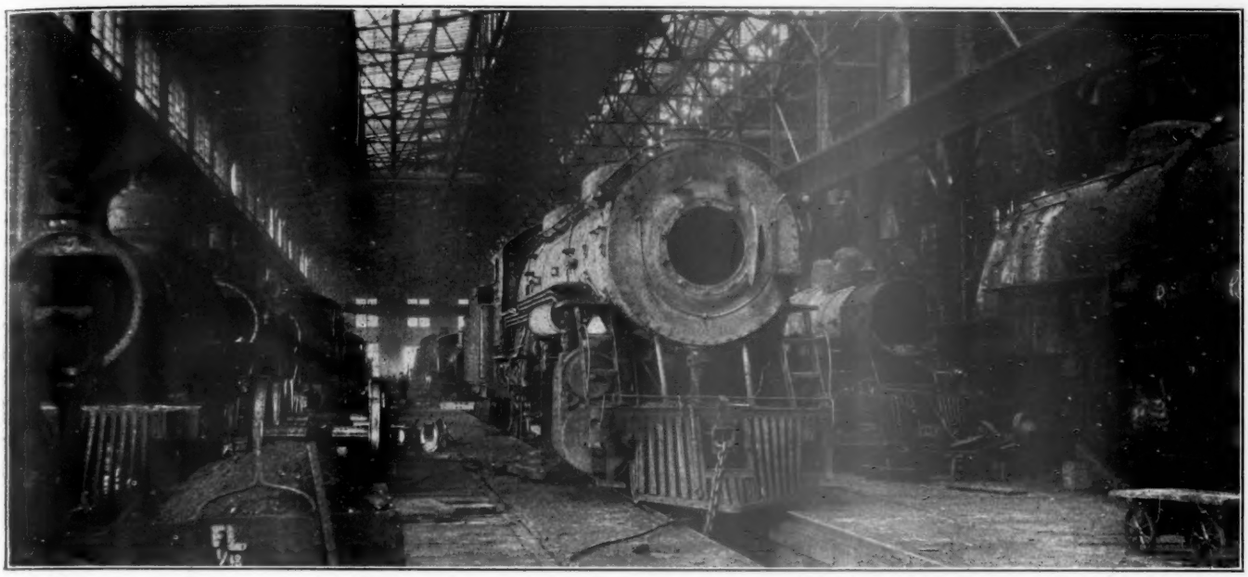
"I am deeply grateful for the cordial invitation extended to me verbally by yourself and also in the telegram of Mr. Chambers and Mr. Tollerton to be present at the session of the American Railroad Association, Mechanical Section.

"It would be a great privilege and pleasure to me to participate in the affair of this evening were it not that other arrangements previously made preclude my being in Atlantic City for the occasion.

"I note that you call it a night of recognition and appreciation of the service rendered by A. R. A. members during the war.

"So far as this concerns the railroad men who served in France, I can speak with authority regarding their accomplishments, and my message to you is that you can go the limit in commending them. I rank their work with the most distinguished performed in France.

"A large percentage of the railroad men who went to France were well beyond the age at which military service might reasonably have been expected, many gave up very rumunerative positions, home ties and all those comforts and conveniences that are so foreign to army life, all to answer the call of their country and to serve in such capacity as they could be used with benefit to the cause. I think that if the facts were analyzed it would be found that of all agencies that contributed over and above what might be termed the reasonable call of duty the railroad profession stands out pre-eminently. I am proud not only of the sum total of achievement of the railroad men in France, but also of every man who had the opportunity of serving there." W. W. ATTERBURY.



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American Railroad Association, Section III, Mechanical

Proceedings Include Addresses by W. T. Tyler, Chairman Tollerton and Frank McManamy

THE FIFTH DAY of the first annual convention of the American Railroad Association, Section III, Mechanical, began with a morning session on Monday, June 23, 1919. The meeting was called to order at 9.45 o'clock by Mr. Tollerton, the newly elected chairman, who asked that the past presidents in the audience and also Mr. McManamy, assistant director, mechanical department of the U. S. R. A., take seats on the platform.

Address of Vice-Chairman, W. J. Tollerton

I HAVE LISTENED to so many excellent addresses since the opening of the convention and the ease with which they were delivered and it would seem that any one should be able to make a public address merely by close observation as to how it was done. However, I am inclined to think that making addresses in public is like the great game of golf, you may be one of a gallery that is following a professional golfer and watching the ease and accuracy with which each shot is made, it seems not to be difficult at all, but when we try it ourselves we generally dub our shots. Therefore, I trust that if my drives are short and I am occasionally in the bunkers the convention will bear with me for I assure you if given strokes enough I will get over the course somehow.

The American Railway Master Mechanics Association is just closing its 51st year and as I had the honor of serving you as President until its consolidation into Mechanical Section No. III. I will therefore address you as Past President of your association.

In addressing you today as President of the American Railway Master Mechanics' Association, I thoroughly appreciate the honor conferred upon me and the privilege of appearing before you in a capacity which has in the past been so ably filled. It is therefore with an especial pleasure that I extend to the members and distinguished guests, a sincere welcome with the hope that this meeting shall be truly beneficial. I am certain that none of us will leave this beautiful city and its charming hospitality with other than the most pleasant recollections.

During these eventful years of change and progress, we have witnessed the growth of a co-operative spirit among nations and national institutions, the far-reaching effects of which, will not be fully appreciated for some time to come. In the railroad field some of these tendencies are already evident. The amalgamation of various organizations is in line with the general trend and will lead undoubtedly to a broader opportunity for useful effort, and a more complete development of the inherent possibilities, than could be expected from the organizations acting independently.

Most of us will view with considerable regret the passing of our old association. In fact had it not been for this sentiment in favor of retaining the identity of the American Railway Master Mechanics' Association, it is probable that a combination of the different organizations would have been effected a number of years ago. While at that time the advantages of a more complete co-operation were realized, there was no urgent incentive to the formation of an amalgamated association. Today, however, we are confronted with problems, the solution of which will indeed necessitate our combined efforts, and in the wise consideration of these matters, we will have increased opportunities together with a graver responsibility than has been ours during the preceding years.

It is only necessary to glance through the published proceedings of the Master Mechanics' Association to realize that there has been a consistent growth right from the beginning, and also that in the various lines of investigation under way, there still remain great possibilities for future endeavor. It would require altogether too much time to attempt anything in the nature of a complete review of the work accomplished by this association during the past fifty-one years. I feel, however, that on this occasion it will not be entirely out of place to mention briefly some of the more important results secured. This is the only true measure of our success and consequently a summary of these results seem to be a logical topic for incorporation in my address as last president of your association.

History of the Master Mechanics' Association

It may appear to some of the members, that a synopsis of this association's efforts is not entirely necessary inasmuch as the modern American locomotive of today might be considered

in itself as a complete embodiment of our work and efforts during the past years. The difference between this machine just prior to the organization of the Railway Master Mechanics' Association and as it stands today, constitutes a vivid fact, infinitely more impressive than any written account. This is the concrete evidence of our labors as members of the old association and in the progress of its development during years to come, the locomotive will still remain as a true representation of our work in the amalgamated organization. It may be of interest, however, to outline a brief historical record of the Master Mechanics' Association, with an indication of some of the results accomplished.

The American Railway Master Mechanics' Association is today just closing its fifty-first year of existence. On June 10, 1868, six railroad master mechanics met at Dayton, Ohio, to plan this great organization. Another meeting was held at Cleveland just fifty-one years ago tomorrow, and was attended by twenty master mechanics, who issued invitations to the first annual meeting held at Cleveland, September 30th and October 1 of the same year. This time there was a more general attendance and the work of the association was formally started.

It was the purpose of these earnest men that annual meetings be held and appropriate committees be appointed to gather from all parts of the country ideas, practices, and the experience of manufacturers and mechanics, then after digesting them thoroughly, to present full and complete reports to the association. In this manner a valuable fund of information has been accumulated for the professional guidance and benefit of railway officials. During the first annual conventions reports on such subjects as Boilers and Boiler Material, Steel Tires, Wheels and Axles, Cylinder and Stuffing Box Packing, Boiler Incrustations, Safety Valves, Material for Flues and Standard Nuts, were presented and discussed.

Development of Standards

Of the greatest value has been the work of the association committees in preparing and recommending various standards and practices, which have been adopted by action of the association assembled in convention, or by a letter ballot of all the members. The first recommended standard was for screw threads, and was adopted at the convention of 1870. Some of the more important standards that have been adopted are for axles, wheels, safety appliances, screw threads, bolts and bolt heads, tires, wheel mounting pressures, formulæ for main and side rods, specifications for axles, boiler and fire box steel castings, cast-iron wheels, cast-iron cylinders and cylinder parts, steel forgings, packing rings, safety valves, steam chests, superheater castings, superheater pipes, boiler and arch tubes, solid and forged steel wheels and valve bushings.

In addition to the above association Standards, the following are some of the more important Recommended Practices that have been adopted:—Rules for the testing and inspection of locomotive boilers; rules for the inspection and testing of locomotives and tenders, air brake and train air signal instructions, photometering of headlights; rules for determining stresses in locomotive boilers; rules for boiler washing; fastenings for tires of steel wheels; standardization of tinware, various gauges and specifications for lumber, wrought iron bars, bronze bearings, steel forgings and castings, cast-iron wheels, engine bolt iron, air brake hose, journal bearings, lap welded and seamless boiler tubes, rivet steel and rivets, staybolt iron and welded pipe.

The above constitutes a brief synopsis of the most important work carried on by this association since its organization. It does not, however, give any indication of the tremendous amount of labor and investigation necessary on the part of the various committee members before the recommended standards, practices and specifications, were finally adopted. Eminent railway mechanics held diverse opinions regarding important details of locomotive construction, regarding the proper proportion of various parts; the strongest and simplest method of building and bracing locomotive boilers to insure them against explosion; the most efficient form and construction of fire boxes to develop the value of the different kinds and qualities of fuel; the relative value of iron and steel plate for boilers, and especially of copper, iron and steel for fire boxes and flues; the relative safety and economy of iron and steel axles, crank pins and truck wheels; the cause and prevention of boiler explosions; and a multitude of kindred topics, embracing a wide range.

In view of the various conflicting opinions held by the members upon these important subjects, a careful and systematic investigation by the different committees has been necessary in order to harmonize and develop a set of Standards and Recommended Practices that would represent the best composite opinion of the entire organization. These discussions and investigations have also had the very excellent effect of awakening and directing attention to the subjects under consideration. It is doubtful if any railroad man can listen to discussions upon matters of vital bearing upon his daily occupation, without having his attention quickened and awakened. He may not always take part in these discussions, nevertheless when he goes home he will see and look for things he never saw or thought of before.

At the convention of 1891, it was decided to incorporate under the laws of the State of New York, as owing to its steady increase in membership and influence, it was felt that the association should be in a position to exercise a legal control over its finances and to make and execute contracts and do all other acts that an association of this kind may do to maintain and perpetuate its existence. Incorporation was effected July 23, 1891.

Association Establishes Scholarships

At the fifth annual convention, held in Boston during the year 1872, there was a surplus of three thousand dollars. By an unanimous vote of the subscribers (merchants and manufacturers of Boston) this money was turned over to the association to be placed in the hands of three trustees, chosen by the association, to be used for the benefit of the association in such manner as the trustees might direct. There were many discussions as to the proper use for this fund, among which was the project of erecting a building for the association. However, the fund was finally invested in government bonds until the year 1891, when with accrued interest it amounted to $6,898.13. A committee was then appointed to find a suitable use for this money and recommended that $5,000.00 of the amount be invested in four scholarships at Stevens Institute of Technology.

In 1903, Jos. T. Ryerson & Son of Chicago provided a scholarship in any institution and assigned the filling of this scholarship to the association. This scholarship provided for $500.00 a year. In 1915 this was changed to two scholarships of $300.00 per year each. These scholarships have been filled every year since first established. They are available to the sons of members and under certain conditions as provided by the constitution to the sons of other railroad employes. Successful candidates are required to take the mechanical engineering course. No more worthy use of money than this can be conceived and it is to be earnestly hoped that there may soon be many more such scholarships under the supervision of the association.

In 1904 the constitution was amended to provide for representative membership on the basis of locomotives owned and operated. Since that date relations between railroad corporations and the association have been very close. Prior to 1904 the membership was entirely voluntary, the members all paying their own dues, but of late years the railroads have manifested great interest in the association, appointing representative members and paying their dues, no doubt feeling that the expenditure was fully justified by the results achieved.

As we look over the activities of the American Railway Master Mechanics' Association during the past 50 years, we cannot fail to be impressed by the work which it has accomplished. Its entire history is a record of splendid achievements in the improvement of the steam locomotive on American railroads. It is the duty of the members of this association to see that the work which has been so ably carried on under its direction is prosecuted just as earnestly under the new organization which has been formed.

Benefits to be Derived from Amalgamation

I am convinced that the amalgamation of the American Railway Master Mechanics' Association with the American Railroad Association offers even better opportunities than formerly existed for carrying on this work, and that it comes at a time that is very opportune to permit us to secure the greatest measure of co-operation. The period of stress through which we have just past demonstrated conclusively the necessity for efficient motive power and adequate facilities for maintaining it to a high standard while in service. Much of our work in

the past has been hampered by lack of funds to carry on improvements. When the re-adjustment of the transportation situation now under way is accomplished there is reason to hope that the financial return which the roads receive will be more nearly adequate and will permit of making improvements in motive power which have long been recognized as necessary to the economical operation of the roads.

The cost of fuel and to some extent, the cost of wages per ton mile are largely determined by the type of motive power and the condition in which it is maintained. These items form such a large proportion of the total cost of conducting transportation, that in the last analysis the extension of our railroad systems depends upon the ingenuity of mechanical men in devising means for reducing the cost of transportation. There are still fertile sections of this country remaining undeveloped owing to the lack of railroad facilities. As the population increases we shall need the additional production obtainable from this territory. The present tendency, however, is toward a decrease in railroad mileage. In fact during the past two years the mileage of railroads abandoned has exceeded the mileage built. Nothing will be more effective in overcoming this tendency toward a reduction in railroad mileage than the general development of improved facilities for the economical handling of light traffic.

Many Engineering Problems Requiring Solution

There is great need for the continued study of motive power from an engineering standpoint. Further investigation is required to determine the best proportions for locomotive boilers and draft appliances. There are many devices now on the market and no doubt many others will later become available, with the object of bringing about a reduction in the cost of locomotive operation. These should be studied and every assistance given toward their further development. The design of machinery for large locomotives is a problem well worthy of our most careful attention. It is also of importance to determine possible economies by the addition of improvements to existing motive power and the advisability of such alterations based on the type and service life of the equipment.

The development of roundhouses has not kept pace with the increase in size and weight of locomotives. The length of time locomotives are held out of service is in many cases unreasonably long. There is a splendid opportunity for increasing the service secured from locomotives, by improving terminal facilities and mechanical men should give the matter careful study.

Many of the technical problems pressing for solution cannot be properly investigated without a complete equipment of testing and laboratory apparatus. Few roads are able to undertake the expense of such work alone and as the benefits are shared by all, the establishment of a joint laboratory for test and research work seems a logical method for furthering such investigations. I believe this association should go on record as recommending a central testing bureau and that an earnest effort should be made to bring such an institution into existence at the earliest possible date.

As we examine the progressive steps whereby the locomotive has advanced from the early crude conception to its present state of comparative perfection, it becomes very evident that in this marvellous growth the locomotive builders have exerted a most decided influence. In fact it would be difficult to exaggerate the importance of what has been accomplished by their engineering ability, not only in the development of locomotive appliances, the perfection of design and proportioning of parts, but also in the adaption of locomotive construction to a great variety of severe operating conditions and the working out of original ideas, frequently at heavy expense. In this connection it is only fitting to say a few words in behalf of the manufacturers of railroad supplies, who by their initiative and energy in the development of new devices have contributed so much to the progress of railroads in this country.

To the Railway Supply Men's Association we owe a debt of gratitude. They have brought together for our inspection what is beyond doubt the most complete display of railway appliances ever exhibited. I desire to urge upon all of you to devote your spare time to the examination of these exhibits, and to bear in mind that the use of more efficient labor saving machinery is probably the only means at our disposal to bring about a reduction in operating costs. The increased wages which employes are now receiving has changed the economic aspect of the shop situation. In view of these altered conditions it has become more vitally important than ever to see that our men are provided with modern tools and facilities. There are no doubt a considerable number of the members, having under their jurisdiction shops filled with machine tools built sometime during the nineteenth century. Practically all of this machinery is operated at a loss and in numerous cases at a very great loss. Many of us have realized for years the necessity for replacing and adding to our equipment of shop machinery, but owing to the ever-increasing burden of expense and financial difficulties under which the roads struggle, it became almost impossible to secure a sufficient appropriation to put the shops on a truly efficient basis. It seems to me that these matters are worthy of our consideration and as members of the combined organization we should have a better opportunity than ever to formulate a definite policy of shop improvement.

In closing I wish to express an appreciation of the work done by the committee members and officers during the preceding year. I am sure that the new organization will receive the benefit of your continued activity together with that loyalty and earnest endeavor which has accomplished so much throughout the life of the Master Mechanics' Association. It is my sincere desire that the members and their families shall secure from this meeting the greatest possible instruction and pleasure with a safe and enjoyable trip home.

Minutes Approved

A motion to approve the minutes of the 1918 meeting as published and transmitted to members was put to vote and unanimously carried.

Mr. McManamy Speaks on Stanardization

AMONG THE CHANGES which the war brought about in the industrial life of the nation there are perhaps none that are more far-reaching in their effect than the general movement towards standardization, not only in railroad equipment, but in all branches of industry.

Because of the necessity of placing each plant engaged in producing articles which were necessary to the successful conduct of the war upon a basis which would insure maximum output, standardization was made compulsory in many lines, and the War Industries Board, through its numerous sections, standardized literally thousands of articles. In so far as some of these were concerned, as for example hardware, hand tools, pneumatic tools, electrical apparatus, etc., the process of standardization was in effect a process of elimination, and because of the comparatively short life of many of these articles in use, some of them may not leave very much impression on our industrial life.

Among the changes in railroad methods that which has perhaps been most commented upon and probably least understood is the standardization of equipment, which was started by Director General McAdoo very early in the life of the United States Railroad Administration, and its relation to production, maintenance and operation of equipment.

In the standardization of rolling stock, where each unit has a prospective life of twenty-five years or more, this standardization could not be accomplished by elimination and required, therefore, the preparation of plans and specifications, with the single object of building locomotives and cars which would have, so far as possible, those parts subject to frequent renewals because of wear, interchangeable on as many classes as possible.

By some, standardization has apparently been construed to mean the preparation of a standard design for equipment which must meet the demands of all classes of service in every section of the country, which of course would be impracticable because it would hamper improvement and retard development.

As a matter of fact, however, nothing of this kind was even remotely considered in connection with the program of standardization of equipment. The fact that the standardization program was entrusted to a committee composed of some of the ablest superintendents of motive power and mechanical engineers in the railroad business, who for years have been active

in the work of this association, together with the engineers and designers from the locomotive builders, should have been a sufficient guarantee that nothing radical or impracticable could come from the deliberations of such a committee.

An effective transportation machine is just as vital to the welfare of the nation in time of peace as it is in time of war. Quantity production, standard parts and efficient performance are just as necessary to efficient industrial progress now as they were one or two years ago.

An attempt to agree on a single standard for locomotives or cars, without regard to the character of the service performed, would of course be impracticable and such a plan must of necessity be a failure. Standardization of certain dimensions and appliances common to all locomotives and the preparation of designs for a number of standard types of locomotives using appliances common to all and which are as far as practicable interchangeable, is an entirely different proposition and is intended to bring about a condition which has been striven for by railroad men during the century of locomotive development which has just passed.

While it has been generally agreed that cars may be standardized, it has been frequently pointed out that the differences in operating conditions, such as grades, character of fuel used, and nature of traffic would make a single standard design of locomotive impracticable. This is entirely true and such a thing was not attempted, but it is equally true that a locomotive that is designed to haul a certain train at a pre-determined speed on a 2 per cent grade will perform that service equally well whether the grade be in the Alleghenies or in the Rockies, and while standardizing the design of locomotives does in a measure prevent some of the various designers from giving undue preference to their individual ideas, experience with the standardized designs has indicated that so far we have lost little or nothing of value thereby.

This, and other associations of railroad mechanical men have been built up almost entirely on the principle of standardization. It will be interesting perhaps to those who have not closely followed the work of this association in its early days to refer to the proceedings of a meeting of this association, held at Adrian, Mich., September 19, 1866, under the name of "Car Masters" at which time the following resolution was adopted:

"Whereas, It is very desirable, in view of our extensive interchange of cars of our various compromise lines that we adopt some uniform plan of building for future use, and

"Whereas, It is found impossible to agree as to a uniform truck, some preferring wood, and some iron, therefore

"Resolved, That we recommend to the Red and White Lines, that they, through the Presidents and Superintendents of the different roads, authorize N. H. Marsh, of the Cleveland, Plainsville & Ashtabula Railroad, and Joseph Jones of the New York Central Railroad, to each build a sample car of such style as in their judgment they may think best, and after such cars are built, and approved by the Presidents and Superintendents of our connecting lines, we recommend that such cars be our pattern cars, and that all roads running in connection conform in all the details to the pattern cars, thereby saving all our companies expense and delay in running and repairs. We would also recommend that in the building of the different styles that the axles and brasses and other parts that it is possible to make so, be precisely uniform, also that Mr. Marsh and Mr. Jones each furnish to each road, patterns for the use of each road, at the expense of the road that receives them.

"We also would recommend that, in view of the constant increase of the cars in the various lines in connection with us, that the Presidents and Superintendents have this matter acted upon immediately in order to meet the wants of roads now building cars. Adopted."

It will be noted in this resolution that they had the same disagreements relative to the use of wood or metal for the different parts of the car that we have today. It will also be noted that the purpose of standardization, as pointed out in this resolution was to save "All our companies much expense and delay in running and repairs."

It will be noted that "Pattern Cars" were to be built which corresponds largely with the method of the Administration in having sample cars built by each of the builders and inspected before they were allowed to proceed with their regular orders and that patterns for the use of each road was to be furnished at the expense of the road which receives them, which corresponds in a great measure with the plan followed by the Administration in furnishing drawings of the U. S. Standardized cars and locomotives.

As a matter of fact, however, the real foundation for standard cars was laid long before the date of this meeting in the adoption of a standard gage of track to avoid expense and delay incident to the transfer of lading from one car to another at the terminus of each railroad, because of the difference in gage of track which prevented cars from being sent through to the destination of the shipment.

Although the standardization of gage of track was pretty well established it remained for the emergency created by the Civil War to bring about the practice of sending cars through to the destination of their lading regardless of ownership.

If the practice of standardization needed any justification the illustration provided by the larger railroad systems, such as the New York Central or the Harriman lines, in immediately proceeding to standardize the equipment of their entire line and extending its standards as their lines are extended, either by construction or purchase, would surely be sufficient, and it has always been difficult to explain why parallel lines operating through the same section of the country over approximately the same grades and handling the same kind of traffic should each have their different designs of equipment.

Changes in operating conditions are constantly emphasizing the need for standardization both in locomotives and cars. Freight cars have for many years been interchanged under the rules of the Master Car Builders' Association, and we are all familiar with the delay to equipment and the added expense of making repairs, including the necessity of carrying numberless parts in stock to provide material for repairs to other line cars which is made necessary by the different types of construction which are now in general use.

It is unlikely that locomotives will ever be as freely interchanged as cars, but at the present time locomotives are rendering an increased amount of service on the railroads of other than owning lines, and the indications now are that during the coming fall and winter this will be further increased, therefore the need for standardization of locomotives is becoming almost as great as for freight cars.

On March 1, 1918, 33 railroads were using 522 domestic locomotives belonging to other lines, and in addition 135 locomotives originally constructed for the use of our army in France, popularly known as Pershing locomotives, were in service on railroads under Federal control. Although the Pershing locomotives have long since been converted back to French standards and shipped overseas, there are at the present time 422 other line locomotives on 51 railroads under Federal control and in addition 200 locomotives originally constructed for the Russian Government, which have been modified for use on American railroads.

Another need for standardization of equipment which has been created by the Railroad Administration is the work which has been done in the way of consolidation of terminals and locomotive dispatching and car repair facilities. The consolidation of locomotive dispatching stations alone has effected the elimination of 820 engine houses end engine house organizations; therefore, many locomotives which were formerly cared for in the engine houses operated by the owning lines are now being handled at a joint terminal.

Nationalization of Railroad Shops

What has been termed the "Nationalization of Railroad Shops" has resulted in 3,493 locomotives receiving repairs in other line shops during the period from January 1, 1918, to June 1, 1919. The handling of these locomotives, both in engine houses and at shops, has necessitated additional material for the particular locomotive, and has frequently caused extended and expensive delays because the material was not in stock at the point where it was needed.

An illustration of this is a case where a Mallet locomotive leased to another line was held out of service for repairs until rental amounting to $4,800 had accumulated, while waiting for a repair part which cost less than $30 to manufacture. In another instance, a leased locomotive was held out of service while rental amounting to $1,680 accumulated while waiting for tires and another while $1,375 accrued while waiting for a piston and rod. Numerous other illustrations of this kind can be given

which amply justify a greater degree of standardization than has formerly existed.

The illustrations given, of delay and expenditure caused by waiting for parts for repairs, are not intended as a criticism of operating methods but rather as a criticism of any failure to use standard parts where they may reasonably be used.

Standard Locomotives and Production

Considering standardization from the standpoint of production it is only necessary to refer to what the builders have done with standard designs as compared with individual designs to see how very much production can be increased.

In this connection, it is interesting to note that one of the large locomotive companies were able to produce 163 locomotives of standardized design in a five weeks' period, while they were able to complete but 104 locomotives of individual design during a similar period, and this experience is typical.

The experience of another locomotive builder during a year's trial proved conclusively that they could produce at least 30 per cent more tonnage of standardized locomotives than miscellaneous locomotives of similar weights requiring separate specifications and a separate set of standards and gages.

Standardization means, therefore, tremendous economies not alone to the builder, but to the purchaser, and for this reason if for no other, the efforts of this association to standardize equipment should be encouraged.

In computing the cost of a locomotive it is of course necessary to include the cost of the design and the making of drawings, patterns, dies and formers. Therefore it will be clearly seen that this expense is multiplied by the number of different designs which are built. Because of this, and the reduced work in the drawing room and in the preparation of bills of material, as well as the reduction in other overhead expenses the cost of standardized locomotives is reduced.

Standards and Maintenance

Standard locomotives and standard cars will reflect superior maintenance and will show a reduction in time at terminals, also a reduction in the time in shop. Parts standard to such equipment can be manufactured in quantity well in advance of the shopping. Men engaged in repairing equipment, because of their familiarity with them, will achieve greater speed than where each vehicle presents new problems in each part.

Striking illustration of this is found in the cases where locomotives were sent to other line shops for repairs, and hundreds of instances have occurred where the time lost by the locomotive due to sending to the owning lines for some minor part or making patterns and manufacturing it has cost more than the entire repair bill.

The Committee on Standardization of locomotives working jointly with representatives of the manufacturers brought about standardization of the dimensions of numerous specialties. These specialties need not be of the same type or purchased from the same manufacturer; in fact they may be of widely different design yet their dimensions were standardized so as to be perfectly interchangeable. This is true of injectors, lubricators, safety valves, power reverse gears and many other highly specialized productions.

The point has been raised that locomotives built to standardized designs will not be uniform with the present standards, therefore, will increase the number of spare parts necessary to be carried in stock. This in some cases will no doubt be true, but as a matter of fact there is no more difference between the locomotives built to standard design, the working parts of which are largely interchangeable with other locomotives, than there is difference between two road classes of locomotives on the same railroad. For instance, there are 66 different items, or 10 per cent, of the total which are standard for all of the 12 standard types of locomotives. There are 110 different items, or 16 per cent of the total which are standard to 9 or more of the 12 standard types of locomotives and there are 165 different items which is 25 per cent of the total number that are standard to 6 or more of the standard types of locomotives.

The importance of this will be more fully realized when we consider the fact that few roads will probably ever require locomotives of all of the 12 standard types. A comparison of the cost of locomotive repairs on various railroads will indicate conclusively that railroads which have developed and which maintain definite well selected standards are experiencing decreasing maintenance cost.

1297 Items Standardized

The work of standardization covered a total of 1297 items, therefore, I shall not attempt to outline all of them but on the locomotives the following are some that will be recognized as facilitating maintenance without in any way decreasing operating efficiency.

All boilers and boiler seams are of the same general design, and in nine classes boilers are of the conical extended wagon top type.

Superheaters of similar arrangement are applied to all, the top header type being used, although the number and length of units varies with the type of locomotive.

Flues and tubes were so worked out that four flue lengths, viz: 15 ft. 0 in., 19 ft. 0 in., 20 ft. 6 in. and 24 ft. 0 in, filled all requirements. All superheater flues are 5½ in. diameter and all fire tubes on road locomotives 2¼ in., and on all switching locomotives 2 in.

The standardization of firebox dimensions permits the interchange of boiler and ash pan details. Without any sacrifice of grate area it has been easily possible to make the firebox lengths the same on five and three classes respectively, and to care for all classes with widths of 66¼ in., 84¼ in. and 96¼ in. Similarly it was found possible to make the grate surface and grate arrangements uniform on three classes with an area of 76.3 sq. ft. each, and two classes with an area of 66.7 sq. ft. each.

Innumerable details are susceptible to standardization. Thus, the dome caps, safety valve fittings, injector check and pipe support, hand rail posts, longitudinal and radial staying, tube and flue end styles, smoke box and other details are interchangeable on all classes of locomotives. Mud ring corners, staying in throat sheet, superheater damper arrangement and smoke stacks are interchangeable for all road classes.

Cylinders are of similar, general design with only differences in dimensions and proportions imposed by the work to be developed. Fourteen inch piston valves are used on all road classes, except the light Mallet. All steam chest and cylinder glands are of similar design.

The diameter of drivers are worked out to give the best proportions for each type within the limitation of the design. Wheel centers and tires are largely interchangeable and three classes of road engines are each provided with 57 in. and 63 in. diameter driving wheels.

In main journals only four sizes were found necessary, viz: 9 in. by 12 in., 10 in. by 12 in., 11 in. by 13 in. and 12 in. by 13 in., and for driving wheels other than main, 9 in. by 12 in., 10 in. by 13 in. and 11 in. by 13 in. journals only are necessary. In addition, other than main axles on some heavy classes are used for main axles on other classes. The same is true of driving boxes and their parts, crown brasses, cellars, etc.

Trailing trucks are interchangeable on all road locomotives except the heavy Mallet and the tires, wheel centers, axles, journal brasses and details are similarly interchangeable.

All leading truck wheels and axles are interchangeable as are brasses, boxes and cellars.

One crosshead pattern serves eight classes of locomotives and other details, shoes, piston rods, etc., are used on two or more classes.

In the design there was borne in mind the entry of better or improved parts at some future time. To illustrate this I desire to point out that the frames of all locomotives have been slotted so that automatic driving box wedges may be applied in the future without the necessity for any machine work on the frames. Three designs of tenders with water capacity of 8,000, 10,000 and 12,000 gallons respectively, satisfactorily meet the requirements of all classes of service.

On the cars, it was possible to standardize numerous items; for example, three trucks with capacities of 40,000 lb., 50.000 lb., and 70,000 lb., respectively, may be used for a total of seventeen classes of cars, so that three patterns each of bolsters and truck side frames, and three lots each of brake levers and brake connections only are required.

Roofs are interchangeable. The dimensions of draft gear pockets are uniform and couplers, coupler yokes, uncoupling mechanism and many details are interchangeable on all classes of cars.

In the design and construction of the cars built on Administra-

tion order the standards of the M. C. B. Association were found of incalculable help, and they were closely adhered to. For example M. C. B. sizes of lumber were used throughout the cars, and wherever possible other items which the M. C. B. Association has made standard were used.

The winter of 1917 and 1918 exploded the theory that in order to render efficient service locomotives must be specially designed for the road on which they were to be operated. When it was necessary to bring western locomotives east, which was done to the extent of several hundred, it was found that these locomotives rendered excellent service and the only interference was due to the difficulty in getting repair parts and getting employes familiar with their repair and operation, all of which would have been avoided by even a moderate degree of standardization.

Standardization of locomotives and cars will reduce the time at terminals and in shops by reducing delays caused by manufacturing material for repairs, because of not having suitable materials in stock. It will provide locomotives that will be familiar to enginemen and repairmen so that no loss of efficiency will result in transferring locomotives from one division or from one railroad to another as traffic conditions require.

It will reduce the quantity and consequently the cost of material necessary to be carried in stock at various terminals in addition to the reduction in delay. The reduction in expenses will be found to be substantial and this is confirmed by the cost figures of those railroads which have to the greatest degree standardized their designs and practices.

In the item of material alone, there would be an estimated saving of 50 per cent in the cost of the spare parts necessary to carry in stock and this saving can still further increased. The cost of carrying $100 worth of material is not less than $5 per annum for carrying charges only, but the carrying charges only, but the carrying charges are really only a small part of the total cost. In addition to the cost of carrying material, there must be included the expense due to deterioration and obsolescence. I have been furnished the figures of a well-officered road covering a period of ten years, which shows that these total figures are almost 18 per cent.

It should also be borne in mind that the interest on the investment, as well as the annual charges to depreciation, must be charged to operation, and this figure on an average railroad, assumes important proportions. Thus, an increase of $5,000 in the cost of a locomotive means an annual charge to interest and depreciation of approximately $450, or say $1.25 per day, and this amount accrues irrespective of the service rendered or the productivity of the investment.

Standardization does not mean stagnation. This is evidenced not alone by the railroads which have extensively adopted this principle on their own line, but by companies which manufacture specialties used in railroad work. No one will accuse the air brake companies of having failed to keep abreast of the times, and yet their product is standardized to a very high degree. The same is true of a great many other specialty manufacturers, which, by the establishment of, and a strict adherence to definite, well selected standards, have built up businesses which are more than nation wide.

Surely no one will say that the adoption of standard dimensions for axles, journal boxes and contained parts, couplers or safety appliances as referred to in the annual address of the President of this Association has had the effect of reducing the carrying capacity or the types of cars which may be built.

As the need for axles with increased carrying capacity became apparent, the need has been met. The American eight-wheel locomotive gave way to the Atlantic type and the ten-wheel passenger locomotive to the Pacific, and when train weights continued, the natural development was the Mountain, so with standards, as the need for additional ones arise, it can be met, without destroying the principle of standardization.

In this connection it is interesting to note the instructions issued by the Direction General of Railroads, when the original committees on the standardization of locomotives and cars were assembled. The instructions which were issued to the Locomotive Committee were to work up specifications for 12 types of locomotives with particular consideration given to creating standards of parts subject to wear and frequent replacement, so that these may, as far as economy and efficiency would permit, be made standard for as many types as possible, and permit the entry of better and improved parts in the future.

Similar instructions were issued to the committee having in charge the preparation of the designs for freight cars. They were charged that plans and specifications should comprise the most improved and modern designs of cars, not only as to structural strength, but having in mind the important questions of:

(a) Original cost.

(b) Maintenance cost for road service, and to be such as to permit the entry of improved or better designs than those described in the plans and specifications.

They were also instructed to provide for the interchangeability of parts, such as standard truck, applicable to various classes of cars, with the same weight carrying capacity, with a view to reducing the material stocks necessary to be carried at repair points throughout the country.

All of these things have been accomplished. It has been shown that it is possible to build locomotives covering practically the entire range, in weight, size, type and service, using to a very great extent standardized parts and dimensions without the introduction of any designs or parts whose reliability had not been demonstrated by extensive service. As a result, 12 classes of locomotives have been designed and built, with a great many parts standard to all of the classes of locomotives and with details interchangeable not only with locomotives of the same class, but with other classes.

The same thing has been true of the cars. Seventeen different classes of cars, including box, stock, gondola, hopper, refrigerator and tank cars have been designed of varying sizes, capacity and kind of construction, and yet it has been possible to not only build these cars so that three kinds of trucks only were necessary, but also to realize a very high standard of car construction. Where standards are adopted under suitable safeguards, and where those not only engaged in the production, but also those who are responsible for the maintenance and operation, have their wishes considered, superior results may be expected.

The success of a transportation company is not reflected by the number of patterns they own, by the sheets of tracings they possess, nor by the number of types of locomotives and cars on their equipment list, but rather by the service they obtain from their facilities and the promptness with which they are able to move the business offered.

The measures of operation is the use which may be had from a locomotive or car. If, by reason of reduction in time at terminals or time at shop, we can add 1 per cent to the time available for service, we have in effect added one locomotive or car to each 100. An addition of this kind adds nothing to capital, costs nothing for repairs and carries no charges for depreciation.

In carrying out this policy of standardization the Railroad Administration has simply followed not only the policy, but the practices which have long been advocated by this Association, the difference being that the Railroad Administration has a greater measure of authority to make its rules effective and it is a notable fact that most of the objections to the standards established comes from those roads which have shown the greatest disregard of M. C. B. standards.

This Association has originated most of the standards now in general use on American railroads, but has frequently required assistance in making them effective. No better organization exists to continue on behalf of the railroads the work of standardization in the future and if assistance is needed to make the rules of this Association effective it is to be hoped that in the final settlement of the railroad problem such means will be provided.

It would be a serious loss to the railroads of the country if the co-ordination of the work of standardization and the spirit of co-operation in the application of such standards which has been fostered during the period of Federal control should be permitted to decrease in any degree and it will be a distinct loss to the railroads, particularly to the mechanical departments, if in the final arrangement some way is not provided to hold all that we have gained and to continue the work of standardization for the promotion of both safety and efficiency in a co-operative way between the Federal government and the railroads as represented by this Association.

In this huge constructive work some mistakes were made, but the sum total constitutes the greatest step in standardization that has ever been taken by the railroads of America, and the standardization committee is to be congratulated on its work.

Critics may magnify minor but irritating defects, and may

minimize the vast benefits to be derived from a reasonable program of standardization intelligently carried out, but in spite of all this, I venture the prediction that among the many progressive methods initiated or fostered by the United States Railroad Administration which will be perpeuated and improved upon, none will last longer, be of more benefit, or give more satisfaction to the railroad men of the country than the program of standardization of rolling stock.

Report of Standards and Recommended Practice (A. R. M. M.)

W. E. Dunham
Chairman

AFTER CONSIDERATION of the present Standards and Recommended Practice of the American Railway Master Mechanics' Association, together with replies received to the Circular of Inquiry, sent to all members, the committee submits the following report:

SPECIFICATIONS FOR SOLID WROUGHT CARBON STEEL WHEELS (STANDARD, Pages 239-242, Sheet M. M. 24).

Attention is called to the fact that the specifications for solid wrought carbon steel engine truck wheels in Section II, Paragraph 7-(1), limit the inner hub projection to 3 9/16 in. as a maximum from the line *AB*, thus making the actual projection from the rim face 1 9/32 in., and that sheet M. M. 24 shows these figures also. Information is submitted which indicates that by far the larger proportion of the railroads specify this projection as 1 1/16 in. and greater, while some few railroads specify it smaller. It is suggested that the wording of this paragraph be changed to read "shall not be less than 3 9/16 in." instead of "shall not exceed 3 9/16 in." The committee concurs in the suggestion.

PIPE UNIONS (STANDARD, Pages 332, Sheet M. M. 19).

The standardization of pipe unions, both flat and ball joint types, as concerns the contour and interchangeability of parts, which was a matter of special investigation with the A. S. M. E. and M. C. B. Associations, in accord with the action of the 1916 convention, and which was dormant during the war period, has again been taken up with those associations. Progress only, at this time, is reported.

The report is signed by W. E. Dunham (Chairman), Chicago & North Western; M. H. Haig, Atchison, Topeka & Santa Fe; A. G. Trumbull, Erie; A. R. Ayres, New York, Chicago & St. Louis; G. S. Goodwin, Chicago, Rock Island & Pacific; R. L. Ettenger, Southern, and B. B. Milner, New York Central.

Discussion

Mr. Dunham: I move that the first item, "Specifications for Solid Wrought Carbon Steel Wheels" be referred to letter ballet for a change in the standard.

Mr. Gaines: I second the motion.

The motion was carried.

Report of Committee on Mechanical Stokers

THE COMMITTEE ON MECHANICAL STOKERS has been reporting to this association since the convention of 1913. It has now become extremely difficult to compile any additional data that might be received with interest and appreciation by the members of the association. During the last two years, the railroads have done very little research or experimental work. Consequently, there has been practically no information established relative to the performance of locomotive stokers in service such as is obtained from specially conducted tests.

This two-year's war period, from a manufacturer's standpoint, however, has been extremely active, and there have been a large number of stokers applied. Inquiry was made of the different stoker manufacturers as to the number of stokers they had actually applied which were in service as of January 1, 1919. The following table indicates the number of different representative stokers then in service and the type of engins to which they have been applied:

Kind of Stoker	Mallet	Mikado	Santa Fe	Centipede	12-Wheel	Decapod	Consolidation	Mt. Type and Mohawk	Pacific	Total
Street	424	638	380	4	14	...	22	3	37	1,522
Duplex	240	804	195	...	...	53	1	1	...	1,294
Standard	120	338	36	...	33	...	21	162	21	731
Hanna	70	6	73	...	16	...	...	4	...	169
Elvin	...	...	1	...	...	...	...	...	...	1
Total	854	1,786	685	4	63	53	44	170	58	3,717

There was a total of 3,717 stokers of the above types in service January 1, 1919. The stoker report of 1917 shows a total of 1,611 stokers (exclusive of Crawford) in service as of April 1, 1917. There have been placed in service 2,106 stokers between April 1, 1917, and January 1, 1919, which indicates the rapid rate at which locomotive stokers are being applied. The types of locomotives to which the stokers are largely being applied are the Mallet, Mikado and Santa Fe, which represent the locomotives of large capacity. The question as to the size of locomotives upon which stoker installations are justifiable is one that is frequently referred to and is yet unsettled. It is the opinion of the committee that the conditions surrounding individual conditions are so variable that no fixed rule can be recommended for guidance in this connection.

Suggestions have been made involving certain limits in the weight and tractive effort of locomotives, the character of fuel used and the rate at which it must be fired. Limitations on the basis of weight and tractive effort of locomotives may be feasible where the locomotives operate under uniformly heavy conditions, but even then there are certain local and physical conditions to be considered that prevent any general recommendation being laid down even on such a basis as this. Locomotives operating in districts where the demand for maximum power is intermittent and for short duration could not be considered on the same basis as locomotives of the same weight and capacity operating where the maximum power is demanded for extended periods. The character of fuel available for firing may also be considered one of the controlling factors in consideration of the application of locomotive stokers to comparatively small engines. In view of these governing factors, the committee does not feel justified in attempting to suggest a ruling which might be followed in the consideration of this phase of the subject, as it is believed that this question will have to be settled based upon the surrounding conditions under which the locomotive is required to operate.

There were some questions of general interest in connection with stoker operations concerning which it was thought well to secure an expression from the roads using mechanical stokers. These questions were sent out to such roads and replies to this inquiry have been received from thirty-two roads; these thirty-two roads represent a total of 1,777 of the stokers now in service. Inquiry was made relative to the kind and character of fuel used, and it is noticed that on all of the roads bituminous fuel is used; the fuel reported varies in heat units from 9,212 B.t.u. to 14,520 B.t.u.

In answer to the inquiry as to whether the same size exhaust nozzles are used on stoker-fired locomotives as employed on hand-fired locomotives, it seems that the general practice is to use the same size exhaust nozzle, although a few roads vary from this general practice. Three roads report smaller nozzles on the stoker-fired locomotives, ranging from 1/8 in. to 1/4 in.

smaller in diameter. Two roads report that they are using nozzles from ⅛ in. to ¼ in. larger in diameter than are employed on their hand-fired locomotives.

The consensus of opinion is that the stoker-fired locomotives burn more fuel than the hand-fired. Where percentages of difference have been expressed they range from 10 to 41 per cent in favor of hand-firing. This difference, however, is expressed in terms of coal as fired and does not recognize the advantages that have been gained by improvement in the performance of the locomotive resulting in uniform steam pressure and more active and uniform performance over the division. These increases in fuel consumption may, in some instances, be considered as the price of firing locomotives of capacity beyond the range of successful hand-firing.

In referring to the continuous performance of stokers over a division, the record indicates that in the majority of cases the stokers are doing about 100 per cent of the firing of the locomotive.

The failures occurring on the stoker equipment are the same old offenders and are classified as "failure of stoker parts," "foreign matter in fuel" and "wet coal." The record tabulated from the information received as to the percentage of failures that may be classified under these three headings is quite interesting in the variety it presented. On some roads the highest percentage of failures is due to broken stoker parts; on others, foreign matter in the fuel seems to be the chief offender, while on others the question of wet coal is apparently causing the most concern and delays to stoker-fired locomotives.

An effort was made to obtain information relative to the cost of stoker maintenance upon a thousand-mile basis. Very few roads keep such a record, and those that have reported on this item, when grouped together, show a very wide range of costs. One road with 92 stokers in service reports a cost of $1.77 per thousand miles, while another road with 54 stokers in service shows a cost of $40.00 per thousand miles. These are the maximum and minimum cost figures presented and indicate the extent of the variation in cost, and if closely analyzed it would no doubt be found that local conditions were possibly largely responsible for the variation.

In the circular of inquiry sent to the users of mechanical stokers, suggestions relating to features of mechanical stokers to which attention should be directed by the manufacturers were solicited, and it might be well to incorporate some of these suggestions in this record. A simpler and more accessible lubricating system has been suggested by several roads. Provision for the better handling of wet coal comes as a suggestion from roads that are experiencing trouble in this respect. Recommendations for more accessible conveyor screws are presented, which might be considered in conjunction with one road which suggests that the stoker be constructed so that it will be less susceptible to failure when foreign material gets into the stoker mechanism with the coal. Provision for overcoming the loss of fuel from the conveyor system may well be considered by the manufacturers as this feature has been suggested as a stoker deficiency. Improvement in the arrangement for the positive adjustments of conveyor adjusting plates is recommended, and it has also been suggested that consideration be given to the design of a system of conveyance of the fuel from the tender to the fire box that will provide against pulverizing the fuel in conveyance. Better protection from dust for the bearings and gears of the stokers is referred to as desirable.

In the report of 1917, additional reference was made to the Elvin stoker then undergoing development on the Erie. This stoker has passed through its experimental stage and it is understood that it is now in condition to be presented as a commercial proposition. The committee has learned that the Elvin stoker now in operation on the Erie is giving very satisfactory service, and that it embodies several individual features which may mean greater economy in mechanical firing. The opinion has been expressed by disinterested parties who have come in contact with this type of stoker and have seen it in operation that, while it may not have reached its final stage of development, there are, nevertheless, marked possibilities in a stoker of this type.

The committee wishes to recognize the unceasing efforts and activity of the stoker manufacturers in the development of their respective devices, and is of the opinion that with continued effort in the light of service experience, a more perfect stoker may be developed in which objectionable features, such as those outlined in this report, will have been eliminated.

The report is signed by A. Kearney (Chairman), Norfolk & Western; M. A. Kinney, Hocking Valley; J. R. Gould, Chesapeake & Ohio; J. T. Carroll, Baltimore & Ohio; J. W. Cyr, Chicago, Burlington & Quincy; A. J. Fries, New York Central, and L. B. Jones, Pennsylvania.

Discussion

Mr. Gaines: When we were working out the administration engines, we heard a great deal of discussion on the stoker, and the thing that struck me most forcibly in that discussion was the question of its lack of economy over hand firing. The discussion seemed to hinge on the point that the stoker, while necessary on heavy power to get the maximum results, was not as economical as hand firing. I have seen the exhibit that is here this year of a stoker that approximates hand firing in principle, and I think it is a very valuable principle and new. Should we have a coal crusher on our engines and carry that unnecessary weight around, or should some method be procured for curing the fuel before we put it on the tank? Carrying this crusher around on our engines is an unnecessary burden, and I think we should go into the feature of purchasing the fuel before it is put on the tank.

Mr. Dunham: The preparation of the coal has always been a very serious detail in the successful operation of mechanical stokers. I believe that the committee can do no better in the coming year than to gather information concerning the cost of preparing coal off the engine as compared to the cost of preparing it on the engine, taking into account the necessary equipment both off and on the engine, and the results obtained in the fire. *I, therefore, move that that be considered very seriously, and if necessary, referred to the general committee for action.*

Mr. McBain: I second the motion.

J. A. Pilcher: In the preparation of coal on my road, which has a large number of stoker engines, they provided, in their new types of coaling plants, a method by which the coal is separated as it passes into the storage bin. It goes over the screen in such a manner that coal suitable for the stokers is stored in one part of the plant, and that suitable for hand firing in another, with the further arrangement that in case there is an over supply of the lump coal for hand firing, that can be passed back through the crusher and into the bins for the stoker firing. That seems to be a very simple solution, although it makes quite an elaborate plant. It would appear to be the best method to have one breaker at the terminal instead of a large number on the tenders.

H. T. Bentley (C. & N. W.): We have just been considering a rather heavy locomotive to be fired with either oil or lignite, and I had a meeting with the locomotive builders yesterday to see how they could handle this particular type of engine. No one seemed to have had any experience with burning lignite coal with a stoker. Are there any members who have successfully burned lignite coal such as Wyoming lignite, and, if so, what kind of stoker was used for that purpose? It is a very serious situation with us. We have large fields of lignite in sight and we would like to get some kind of stoker that would handle it as satisfactory as it does the bituminous coal.

Mr. Fuller: We are handling Wyoming lignite or semi-lignite coal with a stoker; the fuel is prepared for and put on the tender, and with another class we have the crusher on the engine. We have two grades of lignite coal or semi-lignite. The Hanna coal is best, not crushed too fine but about the size of a walnut. It does deteriorate and it does interfere with the stoker operation, in wet weather, when very fine coal becomes thoroughly saturated with water, but I don't think, Mr. Bentley, you will have any trouble either with the Street or Duplex stokers. I presume other stokers are just as good for burning a semi-lignite coal or any Wyoming coal if the stoker is properly handled. We have been very successful with both makes of stokers. We have had some trouble at the start with the Hanna. It was felt that Hanna coal could not properly be prepared at the mine, but we prepare all our coal at the mines with the exception of that for engines that are equipped with a crusher.

Mr. Chambers: I note one item in this report speaking of percentage, increased percentage of consumption of coal with stoker as compared with hand firing. That was no surprise. A new device never starts out with its best effort. There is

much to be learned in the manipulation of a stoker, and the easy part of the job would incline a fireman to waste coal. While I have never had any direct supervision of a stoker engine in operation, I think that a man who would practically starve his fire at all times would have you a lot of coal, because you are taking no chance whatever if you get a little behind. It is very easy to increase the operation and your fire is covered all over at one time. It is not like the hand firing which might develop holes and make your engine go back materially in steam. I am not in favor of the system of automatically sifting your coal out as it goes into the bins. To get proper results you have got to prepare the coal either at one bin or in as many bins as necessary for the system and deliver it to the engines and to the bins in a prepared state.

Mr. Gaines: I think that the committee ought to develop whether or not it is feasible to have the coal producers run the coal over a screen and give you such portion of the screenings as you need for firing. I think that is going to be one answer. If the committee will take it up with the producers, they will find in many parts of this country that the producers would be very glad indeed to take out the lump that is too big to go into the stoker and prepare the fuel without any cost whatever.

Mr. Barnum (B. & O.): To derive any benefit of the figures on increased cost for fuel we should have, to go with that, the increase in the work done. One of the principal advantages realized by the roads using stokers is the increased tonnage hauled by the steam locomotive as compared with the tonnage that can be hauled by that locomotive when hand fired. One of the omst important things for this committee during the next year is to give us something definite in the way of increased work performed with the stoker as compared with the hand-fired engine.

Mr. Fuller: There is no doubt but that a large percentage of the locomotives that were equipped with crushers were equipped because of the inability to use these engines in any territory on their railroad due to lack of having crushers at their coaling stations and their inability to get the coal crushed at the mines. After the crusher becomes a universal equipment there is no doubt but what the engines can run without a crusher on them. Mr. Gaines spoke about having the mines prepare the coal. We have our own mines and we prepare our own coal. Some years ago slack was a drug on the market and they threw it away, but when we got stokers there was more demand for slack than anything else. If you depend on the mines to crush your coal, those of us who have to store coal would want to store crushed coal. The loss in deterioration would be so great that I don't believe you would want to do it; and if you did store lump coal and did not have a crusher you could not crush your coal. I believe from our experience that we have to put crushers in our coaling stations and crush coal when we want. If you don't have a crusher on the engine, then you will be up against it.

Mr. Gaines: Perhaps I did not make clear the preparation of fuel. At the mines in Alabama they are very glad to screen the coal, run it over a three-inch mesh screen and give you the screenings and take the lumps out, and when that has been done it is all ready for the stokers. The next thing to be considered is storing the screened coal. It is surprising how little that deteriorates. I have had experience for four or five years with storing the nut coal to take us through the winter season. About Christmas time it is almost impossible to get fuel for your locomotives unless you store it in the summer, the demand for domestic fuel is so great and the depreciation is certainly very, very small. I would say that it is less than 5 per cent from tests we have made.

W. J. Bohan (N. P.): The question of whether we should store coal in prepared form for delivery to the locomotive or whether we should load reasonably prepared coal on the engine and there crush it for the firebox is one that should be approached with extreme care. The subject is very apt to be looked at from the viewpoint of local conditions instead of looking at it as a machine that would have to be used to take care of coal over a very wide area. We are approaching a period when lignite coal will necessarily be used on locomotives and we should creep before we walk. We are too prone to take broad jumps without making preparation. We can't afford at present to equip the coaling stations necessary. We have lots of territory west of the Mississippi river where a highly developed coaling station would be a failure. We lose sight of the fact that there are thousands of miles of outlying territory and very few miles of the territory where the operation is intense, and where, perhaps, specially prepared coal would solve the problem. All we need at the coaling station is a clean, dry coal. We have to burn the coal, both lump and slack and poor and good, and the thing we should do at the present time is to develop the stoker that we have started out with to its highest possibilities, before attempting to install highly developed and expensively operated coaling stations.

Mr. Kinney (Hocking Valley): This committee does not desire to convey the impression that the stoker is not an economical machine on the locomotive. We have attempted to make it plain that in all cases where the stoker is applied it is where the range of successful hand firing has passed and you are applying the stoker for the benefits that will come from it, and these benefits are derived in other directions. We would very much decry any thought that this meeting would have, or individuals here that are considering or are operating stokers, that the stoker is not an economical proposition. As to the preparation of fuel. The stokers come on your line perhaps one one or two engines. You are not prepared to put in an expensive plant. These devices and methods that have been placed in use on the locomotives are in their infancy, and possibly, as time will tell, a makeshift in the development of the stoker. This committee will be very glad to have the co-operation of all users of stokers.

F. P. Roesch: In regard to the preparation of coal for the use of stokers, you will recall, the original stoker that was put out used prepared coal, and there are more of this type of stoker in use at the present time than of any other type. We met with considerable difficulty, due to the fact that all locomotives on all railroads using this stoker were not equipped with the stoker. The result was that it was necessary to carry two kinds of coal, having a two-compartment shute. The coal for the Street stoker is prepared at the mines, either by means of crushing or screening. I have known of instances of railroads equipped with this type of stoker where the coal is prepared at the mines and a mistake was made in the billing of the coal, the result being that the division using the hand fired locomotives received the prepared stoker coal and the divisions having the stoker fired engines had the lump coal. You may say that such a mistake as that is inexcusable, but such mistakes do occur. We know that this fine screened coal is not the best coal for hand firing. We also know from tests made at the University of Illinois and on various railroads ha lump coal, screened lump coal, is not the best coal for firing. We will get the better results through the use of a mine-run coal, in view of the fact that it is not probable that any railroad will be operated with all stoker fired engines; it would be well to give the matter of taking the crusher off the engines very serious considerations before any recomendations are made in that direction. It costs a little more to crush coal; there is a great loss of crushed coal in transit, there is a great loss at the chutes, and it will not store due to the fact that it is more liable to spontaneous combustion.

I do not know whether the Alabama coal that Mr. Gaines speaks of fires in that way. All of these things must be taken into consideration before we make any recommendation toward the elimination of the crusher on the engine.

In the handling of lignite, the quality of the coal makes absolutely no difference; it is simply a question of capacity, and the stoker as now developed is of a sufficient capacity to successfully fire the largest locomotives that we have.

So far as the economy of the stoker is concerned, when compared with hand firing, if we take into consideration the fact that the stoker in itself has never burned a pound of coal, we can see that the lack of economy is not due to the soker as a machine, bu to the man who is operating it. If we educate the man to handle the stoker in the way we have educated them to handle the scoop, we will get exactly the same results, or possibly better results, from the stoker in pounds of coal per thousand gross ton miles that we get from the scoop.

Mr. William Schlafge (Erie): We have, on the Erie, approximately about one hundred and fifty stoker-equipped locomotives. It would be expecting rather too much if you did not have trouble with the stokers as they are not entirely out of the experimental stage. We usually experience trouble with any new device that is put on a locomotive. We have had troubles with air pumps and the injectors and without an exception you will have trouble where a new device is put on a locomotive. Such troubles the designer cannot foresee and service conditions

only can produce them. The stoker makers have worked out an efficient stoker, so far as the delivery of the coal to the firebox is concerned. They, undoubtedly, will work out the problem of an economical stoker and in my opinion it will be just as economical as intelligent hand firing.

We have our coal prepared at the mines. We did have some trouble, but that was due to the conditions of the period that we went through. We can now get our coal prepared in any way we may specify. While there is no data, I am very much of the opinion that there is no economy in making a coal breaker of every locomotive equipped with a stoker.

The committee recommended that in breakdowns there should be a weak link provided somewhere in a convenient location and I think this is a good recommendation. Our troubles today are he breakdowns mostly due to foreign matter getting in the machinery. We have one engine equipped wih the Elvin stoker, which is very satisfactory. When foreign matter gets into the machinery the engine stops, but it is only a small matter to remove the obtsruction and start the engine.

We ran a test sometime ago, as I remember it about two years ago, on the Kent division, and later on ran a test on the Meadville division. We are conducting further tests now. I believe we will be in a posiion to give the committee some valuable information for its next report.

Mr. Gaines: I believe that a scheme can be worked out at large coaling plants whereby you could screen the coal as it goes over the chutes into the tenders, taking the lump coal out for hand firing the engines, and using the slack for the stoker. The committee should look into that, and see if something of that kind could not be worked out at the coaling plants to properly prepare the coal for the stoker and also the lump coal for hand firing.

Chairman: The motion before the house is that the report be received and the committee continue with special instructions to investigate the preparation of coal.

(*The motion was put to vote and duly carried*).

Automatic Coal Weighing Devices

Mr. Barnum: I made some inquiries about the automatic coal-weighing devices for locomotive tenders and started with the locomotive builders, but was unable to find that any of the principal locomotive builders had built any tenders with any coal-weighing devices. The only record that I was able to find of such devices being tested was a case on the D. L. & W.

H. C. Manchester (D. L. & W.): We did test out for about a year a coal-weighing device which was invented by L. A. Watres, the same gentleman that invented, the National graphite lubricator. It consisted of a separate coal container, built so as to fit inside of the coal space in the tank. It was set on a scale arranged underneath the coal container, and supported by the tank frame; a gage which was located upon the left leg of the tank in view of the engineer and fireman, showed in actual pounds, how many pounds of coal were in the container at all times. The experiment was very much handicapped at first in getting the proper gage, but after a time that was quite satisfactorily taken care of. There was some difficulty with the dust and particles of coal getting around the device and the mechanism of the device underneath, and we were never able to quite satisfactorily solve that difficulty so as to get satisfactory results from the apparatus. Therefore, we abandoned the test after a number of months, and have done nothing further with it. That is about all I can say, and that is about as far as we have gone with it.

Snow Fighting Equipment

C. E. Fuller (U. P.): I really know very little about snow fighting equipment. Of course, we have to fight snow in our line. Our experience is that it requires different kinds of plows to some extent to successfully fight snow. The trouble with the rotary plows is that there have been too many people who have attempted to buck snow with the rotary plow, which you cannot do. If you endeavor to do it, the rotary plow will soon be put out of commission, because it will not handle snow in a snow bank, unless you have sufficient power behind it to keep the plow fed up with the snow. The capacity of the plow is controlled by the wheel.

In the winter 1916-17—I think it was in that year—we fought snow for about five months constantly over the Rocky Mountains, and it was a fight day and night. The snow would blow from the up mountain and collect on our tracks just as fast as we could take it out. We got up a plow built new from the ground up. It is a bucking plow, a plow that it is necessary to get a speed up of twenty-five or thirty miles an hour, with three or four engines, depending upon their size, to shove it through the drifts. After we had worked with the rotaries and fought the battle until pretty nearly everybody was down and out, the home manufactured plow was put into commission and kept the road open the balance of the winter. The plow was christened the Fuller plow, I don't know why, but we built the plow and we had a great many of them. Our transportation people can't speak high enough of them, after they learned that they would stay on the track, and there wasn't any danger in operating them. They are scattered all over our railroad now. There is just one feature of this plow that has made it a success, and that is the nose of the plow. It digs down in place of digging up. Most of the plows, the push plows, will mount the rail in hard snow or other conditions. The greater the load, the more this plow hangs to the rail.

Mr Bentley: Dan Cunningham, of the Denver & Rio Grande, suggested to me that a paper on snow-fighting apparatus would be entirely proper, and I think it is a very good subject, if the Committee on Subjects will permit of that being given consideration. I think there are a number of us who would like to get some information about snow fighting. We are fighting all the time during the winter months and sometimes we have derailments that are caused, the superintendents say, by the type of plow we use and the type of car we use behind the plow. It is a real live subject, for the Northern roads particularly, and I move you, that we have a paper on snow-fighting apparatus.

Mr. Fuller: Last April, I believe it was April, we had a tremendous storm in Kansas, wet snow *and very heavy*. We had one of these plows going over a part of the Kansas division. Telegraph poles were all on the track, wires and everything else, and there was a passanger train stalled on the main line. They opened the switches at each end so that if anything was coming which they did not know about, they would be protected. The snow plow came along. It saw nothing, it found the telegraph poles, and finally it landed into a box car and cut it to pieces and went through another one; while it damaged the plow, nobody was hurt and the plow was not off the track. We have only had one derailment of this snow plow, and that was on a branch line due to the ball of the rail being broken for about two feet; the plow went off the track and did a iot of damage, with two engines behind it. Two men were killed and two were injured. But it is our opinion that if the rail had been sound the plow would have gone through this drift as it had been going for several days under the same conditions, without any trouble.

Dan Cunningham: One of the reasons that I suggested this subject is that the snow-fighting equipment receives so little attention that it is something like the Arkansas Traveler—"When it is raining we can't fix the roof, and when it isn't raining we don't need it." Recently I was connected with a road that had to fight snow for eight or nine months a year. It was in an elevation of about 11,600 feet and had 28 miles of 4 per cent grade, so we really know what the snow game is. Some snow is better handled with flangers of different kinds, and others with the appliance that Mr. Fuller has just mentioned, and others with the rotaries. The rotary game is somewhat complicated, because there are so many things about a rotary plow that will give out.

Mr. Gaines: Mr. Chairman, I am going to suggest that the Secretary get in touch with Mr. Fuller and procure the drawings of his plow that he has described this morning and attach them as part of the minutes of this meeting.

Mr. Fuller: This plow is not patented. It is one of our own design and everybody is welcome to it.

Mr. Barnum: I second Mr. Bentley's motion.

(*The motion on being put to vote was carried.*)

The Chairman: There seems to be another motion before us—the incorporation of the drawings of the Union Pacific plow with this report, if that motion has a second.

Mr. Bentley: I second that motion.

(*The motion was put to vote and carried.*)

A Remarkable Exhibit of Railway Artillery

Conventionites Accorded a Rare Privilege Through Courtesy of the Government and the Manufacturers.

THERE ARE TWO EXHIBITS of railway artillery at the conventions this year. One of these, The American Car & Foundry exhibit, which is made possible through the courtesy of the Ordnance Department of the United States Army, was described and illustrated in the *Daily Railway Age* of June 23d, page 1685. The other one, that of the Baldwin Locomotive Works, which consists of a 7-in. caterpillar gun mount and a 14-in. railway gun mount, built for the United States Navy, was described in the *Daily Railway Age* of June 19th, page 1494. The first of the 14-in. naval guns that were placed on railway mounts which were built by the Baldwin Locomotive Works, are familiar to the readers of the *Railway Age,* descriptions having been published in the *Railway Age* of November 1, 1918, page 767; November 15, 1918, page 875; and November 29, 1918, page 967.

In connection with the American Car & Foundry Company's War Activities Exhibits and through the courtesy of the Ordnance Department of the United States Army, Major E. D. Campbell, Railway and Seacoast Section, Artillery Division, Ordnance Department, United States Army, gave an illustrated lecture last evening on "Railway Artillery." The *Railway Age* owes an apology to Major Campbell for having announced in an earlier issue that he was connected with the Navy Department. Extracts from Major Campbell's address follow:

Major Campbell's Address

The popular idea of railway artillery is that it is a development of the recent war. As a matter of fact, it is almost as old as the railroads. It is important to remember that, so far as we can find any record, it had its beginning as early as the Civil War and was used by both the Confederate and Union forces at that time. Thus, railway artillery is doubtless an American invention. The development since the beginning of the world war has been so rapid as to make previous efforts seem of small consequence.

During the campaign against Richmond the Union forces used a piece of artillery which created great havoc among the Confederate gunners. This was a 13-in. mortar weighing 17,000 lb., mounted on a reinforced flat car having eight wheels. During the period from 1863 to 1912, while the idea of mounting guns on trucks had not been discarded, only crude railway mounts of an experimental nature were produced. France and Germany, according to record, appear to be the only countries actually working with railway artillery during these years. In 1912 the Schneider Company, a French manufacturer, produced a 200 mm. 8 in. howitzer railway mount, which was quite a step forward in the design of railway artillery. This mount possessed some of the features which were used in the design of railway artillery during the late war.

America manufactured some railway mounts during the year 1912 for use in the Panama Canal Zone. The cannon mounted on the cars were small, being 4.7 in. howitzers. During this period the main idea for the development of railway aritillery in the minds of the designers was its obvious use for coast defense work. However, during the present war, the use of this artillery has been confined to field operations entirely, necessity of its use for coast defense not having developed.

Design Problems

Transportation Problems.—Transportation of railway mounts involves a problem of design that requires the closest consideration of weight, clearances, and the type of track used. You will appreciate that in handling mounts weighing 600,000 lb. and upward, a system of trucks must be utilized that combines perfect equalization and flexibility. Trucks have been designed which have 4, 6, 8, 10 and 12 wheels each. Conditions of road beds in France have limited all axle leads to 17 metric tons each, and this limitation has been followed in the design of equipment intended for foreign service. Trucks to meet these requirements have units, with short wheel-base, connected by span bolsters.

Railway clearances present limitations to the design of all heavy railway artillery that are ever present to handicap the engineer. It is absolutely necessary to give careful consideration to this point in order to transport your mount over any line that an emergency calls for. To keep within this clearance, it is necessary to swing the larger guns out of balance in order to keep the trunnions sufficiently low and at the same time get proper elevation of the gun. In fact, on some mounts where this is not done, an excavation between the rails is required in order to take care of the recoil of the gun at high elevations. These conditions impose extra work and complications which, you will appreciate, enter into the production of railway mounts, but which, none the less, must be met and overcome.

The Ordnance Department has made an extensive study of railway clearances covering both European and American railroads. A map has also been prepared of the coastal lines, the main transcontinental lines and a few central, north and south lines.

Regardless of the care and patience exercised by the Ordnance Department, in designing railway mounts, that could safely be transported over American and French railroads, most of the roads seem to have the opinion that these features have been entirely overlooked in the design. Some peculiar incidents have occurred in the shipment of railway artillery, as, for instance, one prominent Eastern railroad held up a railway mount on its way to the Coast with the information that it would not meet their clearances. Yet two other mounts of exactly the same type had been shipped over the same road without a murmur.

Carriage Problems.—In designing a railway gun carriage one of the big problems involved is to transmit the force due to firing to the earth with the least number and complication of parts. Many different methods of accomplishing this result have been developed, of which the American railway mounts, to be described, are typical examples.

The main features entering into a railway mount design are the recoil system, traversing mechanism, elevating mechanism, and the means of securing stability when firing. These four elements are common to both field and railway artillery, but certain limitations are imposed in railway mounts which bother the designer. The type of railway carriage to be designed fixes, to a large extent, the four features just mentioned. Likewise the converse is true, namely, that these features govern the type of carriage to be designed. Many other elements enter into the design, but once the above are fixed, a

definite type of carriage necessarily follows this decision. Consequently, in designing railway artillery, as is the case of any high-class machinery design, definite uses or special work to which the railway artillery unit is to be used must be given first consideration.

American Types

The two desirable features in the design of railway artillery, namely, that of having an artillery piece which can be quickly emplaced in a battery and that of having a piece so designed as to permit the gun to elevate to any angle up to 42 degrees and to be traversed around the entire azimuth, have been met with in the 8-in. mount in a highly satisfactory and efficient manner. This mount is the only one of its kind in existence, and perhaps represents the highest type of railway artillery. When in firing position this railway mount is supported by a firing platform consisting of four 8-in. H beams, on top of which are placed six cross-ties. The H beams are simply laid on the railroad ties with no spiking, neither do the oak cross-ties require any fastening to the H beams. This emplacement can be laid in position in 15 minutes by a common crew and of course can be removed in less time. When firing at right angles to the track, the side outriggers of the mount are used. When firing railway mounts the trucks are relieved from the shock of recoil.

The gun carriage, known as the 8-inch Barbette Carriage Model of 1918, is mounted on a base ring which is bolted to the car underframe. Traverse is secured by means of a racer which rolls on a roller path formed by machining the top surface of the base ring. The rollers, of which there are 24, are forged steel, 4 inches in diameter, spaced equi-distant by means of a distance ring. Motion is imparted to the carriage by means of a hand wheel which moves a pinion whose teeth mesh into a circular rack secured to the base ring. A system of gears transmit the hand power at the wheel so that one man is able to traverse the carriage with ease. The gun can be elevated from zero degree to 42 degrees by means of an elevating rack secured to the cradle and turned by worm which is rotated by means of gears and hand wheel.

The car part of this railway mount consists of a structural steel drop type of under frame supported by two 4-wheel 70-ton trucks of the Pennsylvania standard 70-ton type. The underframe of the car is a daring departure from accepted car practice in that the center portion drops abruptly. It is recognized that this weakens the car in its resistance to buffing shocks, but in railway artillery this does not present a serious disadvantage. The car is 40 feet 6 inches between end sills, which are 15-inch channels. Both the center and side sills are the box girder type of construction continuous between end sills. Each has top and bottom cover plates and a ½-inch plate covers the entire under frame. Seven cross-ties are interposed between the body bolsters. The body bolsters are of single web construction, having top and bottom cover plates. The underframe is of structural steel construction throughout except the special transoms which take the side outriggers and special transoms for the jacking mechanism.

As an auxiliary feature it is possible to transport this car on 60 cm. gage track by means of special narrow gage trucks, which take the place of the four-wheel standard gauge trucks. It is necessary, however, to remove the gun from the cradle in order to bring the center of gravity sufficiently low to prevent overturning. This railway mount weighs approximately 180,000 lb., which load is carried on two 4-wheel standard gage trucks or four 6-wheel narrow gage trucks. The gun used in this mount is known as the 8-inch Seacoast Gun Model 1888, considerable numbers of which were withdrawn from the seacoast fortifications for use as railway artillery. It has a maximum elevation of 42 deg., with a corresponding range of 21,000 yards. For field use it fires a 200-lb. projectile with 65 lb. of powder.

7-Inch Gun Railway Mounts

Some 7-inch 45-caliber guns were secured from the navy and mounted on the same type of car for operation along our coast as protection against submarine attacks. This car embodies the same outrigger and float idea for securing stability, but is somewhat different in the underframe construction, the main difference being the installation of hydraulic jacks in place of the screw jacks used on the 8-inch railway mount. This mount does not use any emplacement or firing platform, but is simply lowered so that the cross ties rest on the rails. It weighs 171,000 lb. The trucks are 4-wheel Pennsylvania standard, two of which weigh 21,000 lb. The gun is 45 calibers in length, the range is 17,000 yards, with 15 deg. elevation. The projectile weighs 165 lb., using a powder charge of 58 lb.

12-Inch Mortar Railway Mount

This same type of car is also used for mounting 12-inch mortars except that six-wheel standard trucks are used in place of the 4-wheel standard 70-ton trucks. The carriage for the 12-inch mortar has all the advantages of the 8-inch barbette carriages, but is substantially different in design. This difference is in the recoil system, which utilizes a hydraulic cylinder using piston buffer for recoil with an air pressure arrangement for counter recoil. The air is compressed by the recoil of the piece, thus utilizing a portion of the energy of recoil. Six-wheel trucks are used under the 12-inch mortar railway mount in place of 4-wheel standard gage trucks. These 6-wheel trucks are unique in their design since the wheel base and center plate heights are the same as the 4-wheel trucks. As a matter of fact the 6-wheel trucks can be interchanged with the 4-wheel trucks.

14-Inch, Model E, Railway Mount

During the year 1915 a design was started for a railway mount of sufficient capacity to mount the 14-inch Army gun, which would have all around fire, and which could be adapted for seacoast defense. For seacoast work all guns must have at least 180 deg. traverse, and must be easily operated, since the objective is always a moving target. This mount was designed for seacoast work primarily and requires a special emplacement, consisting of a base ring carried on a flat car accompanying the mount. This base ring is inserted in the track and is provided with a roller path on its top surface on which the gun carriage is traversed after the trucks are withdrawn. The method of maneuvering this mount is to first emplace the base ring on any part of the track desired, then running the mount over this emplacement. When it is in the exact position the entire car body is jacked and the trucks withdrawn. It is then lowered in position on the base ring, the rear end resting on an annular support. The trucks used under this mount are of 8 wheels whose diameter is 31 in. The journals are M. C. B. 6 inches by 11 inches. The trucks are the rigid side frame type, with cast steel bolster and transoms. The weight of this mount is 436,700 lb. The two trucks weigh 56,000 lb.

The gun is a 14-inch Army gun, 40 calibers in length. It has a range of 32,000 yards at 30 deg. elevation. The projectile weighs 1200 lb. and utilizes a powder charge of 360 lb.

The railway artillery which I have just described is on exhibition during this week. The mounts are so designed that they can be used either in the field or for seacoast work.

American 12-Inch Sliding Railway Mount

The American 12-inch sliding railway mount weighs 600,000 lb., mounting a 12-inch 50-caliber gun. It is similar to the French A'Glissement or sliding type, in that it has no recoil mechanism or traversing mechanism. The entire mount is 105 ft. long. Each truck weighs approximately 20,000 lb. This load is distributed over 32 wheels, giving approximately 18 tons per axle. The mount can negotiate curves as sharp as 16 degrees and has been moved at the rate of 45 miles per hour. The gun on this particular mount is one of the most powerful in existence, being 12 inches in caliber, 50 calibers in length, and having a muzzle velocity of 3200 foot seconds. The range of this gun is approximately 45,000 yards. The projectile weighs 700 lb. and uses a powder charge of 305 lb.

16-Inch Howitzer

In the case of the 7-in. and 8-in. guns and 12-in. Mortar, the firing platform is so simple that only a few minutes are required to put it in position. By actual test one of these mounts has been brought up to position, firing platform and outriggers placed, five rounds fired, platform and outriggers replaced on car, and the mount gotten under way, in 37 minutes.

In the case of the large guns and howitzers considerable time and labor are required to prepare the mounts for emplacement. This is a serious matter in the case of large mounts when used in the field for various reasons; one being, that the enemy is likely to observe the work of preparing the emplacement by means of aeroplane observers after which it would only be a question of a few hours until the enemy could drop a large shell which would obliterate that part of the landscape. Another reason is that in case of sudden advancement of the enemy, sufficient time is not allowed for withdrawal of the railway mount, due to the fact that so much time is consumed in preparing it for transportation, thus inviting its destruction or capture by the enemy. Hence, any railway mount which can be brought into battery and withdrawn in the course of a few minutes, has a distinct advantage over the other types.

The 16-in. howitzer overcomes the above disadvantages and is perhaps the very latest type of railway artillery. This mount carries the huge 16-in. howitzer, which is probably the most powerful howitzer mounted on a railway mount. This howitzer can be fired directly from the trucks on standard gage track. The shock of recoil is taken care of through the recoil mechanism and in moving the car backward along the track on its own trucks. Two 12-wheel trucks with specially designed truck frames and spring arrangement are used so that the recoil shock is comfortably transmitted through a system of equalizer springs to the rails. Ordinary rock-ballasted track of 80-pound standard rail is used, and after repeated firings, the test track shows absolutely no distortion.

The spring arrangement on these trucks is worthy of interest, inasmuch as both semi-elliptic and volute springs are used. The semi-elliptic springs are of sufficient strength to withstand the firing load. The volute springs, which are interposed between the semi-elliptic springs and equalizer beams, are designed to take the carrying load only. Thus on firing the gun the volute springs go solid and the shock of recoil is transmitted to the semi-elliptic springs. The truck is the locomotive type using inside journals with 6½-in. x 12-in. journals. An immense combination bolster and transom casting connects the locomotive type of side frames so that the load at the center is uniformly distributed along the side frames. These trucks are equipped with both hand and airbrakes, which, of course, are of special design.

Other Railway Mounts

The Ordnance Department has four other types of railway mounts in existence. These include a French type, known as the 305 millimeter Schneider Railway Mount, which is very similar to the American 12-inch Sliding Railway Mount, and is operated from a curved track or epi. The 12-inch French Batignolles railway mount is another French type using the Army 12-inch gun. It is equipped with the hydro-pneumatic system of recoil. The mount is fired from a firing platform which is carried on a ground platform car. The other two railway mounts in existence are the 12-inch Howitzer and the 16-inch Howitzer Model E. Both are adaptable for seacoast defense since they have all around fire.

It is perhaps wondered how it is possible to negotiate curves with some of the railway mounts having 8, 10 and 12-wheel trucks. Contrary to what might be expected, every truck and mount is subjected to a test requiring that it negotiate a 17-degree curve. The ability to round curves is secured by means of extra pedestal clearance on the inner sets of wheels and the changes in wheel gages on the same set of wheels. It is only necessary to do this on trucks with more than eight wheels each. It has been found in practice that these two methods give all the flexibility required.

It is necessary in the design of railway artillery to so detail the construction that both the French State standard screw couplers and buffers and the American M. C. B. couplers and draft gears could be applied in the field. All the mounts sent abroad, of course, were equipped with the French standard. When these mounts were returned, the French couplers were taken off and the M. C. B. equipment installed. Although the French do not use any airbrakes on their railroad artillery, the Ordnance Department received instructions from General Pershing to equip all railway artillery with both hand and air brakes. The application of air and hand brakes to the trucks is an exceedingly difficult task. No standard locomotive or car brake arrangement could be utilized. The loads of course are static loads and after considerable experimental and development a brake power of 40 per cent was adopted. In most all cases this entailed the use of two airbrake arrangements utilizing two cylinders with other auxiliary equipment. On all trucks except four and six-wheel trucks, all the air brake apparatus is contained in the trucks. It was exceedingly difficult to so design the trucks and air brake arrangement to secure this feature, of having the brake arrangement self contained in the trucks.

It was early found out that the secret of safe running of heavy artillery was keeping the axle loads down to 17 metric tons. This necessitated the use of many wheels and axles on the extraordinarily heavy mounts and the question of clearance and negotiating railway curves immediately came up.

Armament Train

The organization of railway artillery is made up of regiments, battalions and batteries. A battery consists of four pieces of railway artillery, together with armament train cars. A battalion consists of three batteries and a regiment of two battalions. The armament train cars include ammunition, supply, spare parts, fire control and repair cars. The ammunition car is a steel car

with a wood lining equipped with ammunition racks for storing ammunition. A trolley hoist arrangement is also provided in this ammunition car for transporting the ammunition to the platform of the gun car. This trolley I-beam hoist can be projected through the end door of car so that ammunition has a continuous run on to the gun car platform. The construction of the ammunition car is somewhat similar to the 30-ton box cars supplied for use in France by the Director-General of Military Railways. This car has a steel roof, very similar to the construction of passenger car roofs and built up plate and angle carline sufficiently strong to support 16-inch shells weighing 2400 lb. The underframe of the car as well as the entire construction meets the M. C. B. requirements and the Interstate Commerce Commission rulings.

A fire control car is somewhat similar to an ammunition car except it has wooden roof and wooden sheathing. The supply car is a low gondola car with no distinctive features.

The repair car is of exactly the same construction as the fire control car with the interior equipped with machine shop, carpenter shop and blacksmith shop. Great care was exercised in procuring the equipment for this repair car, so that a complete outfit of tools sufficient for all repairs in the field, except those occasioned by direct hit, could be made. The machine shop part of this car has a lathe, shaper, radial drill, grinder, work bench and complete outfit of tools, gages, micrometers, etc. The machine tools are motor driven, current for which is furnished by 5 k. w. gas electric set.

Camouflage

All railway mounts for use abroad were camouflaged by the Ordnance Department with the Ordnance five-color contrast system of camouflage. To the uninitiated it will appear that no preconceived arrangement of colors is used in painting this railway artillery. As a matter of fact, the colors and their arrangement on the mount is scientific, and will effectually conceal the piece from aeroplane observation. Shadows cast by any object on the ground are very distinct from a height, and it is necessary to conceal the outline of the shadows as well as the outline of the mount itself. For this reason railway artillery units are hidden under camouflage screens or canopies which are so constructed that no distinct shadows are apparent.

It is interesting to note here that the invention and use of microphones locate the position of heavy artillery by sound. At the time of the signing of the armistice the Americans had enormous quantities of these planted on the western front. I am told that 400 German guns were located and put out of commission by this system. It is doubtful, however, if the use of the microphones will do away with camouflage. The use of the microphone is only possible after sounds have been produced. Unless the artillery is camouflaged it could be located and destroyed before a shot was fired.

Future Types of Artillery

A forecast of the future types of railway and field artillery is worthy of our attention in the light of all the experience gained during the war. In spite of the popular appeal to the imagination, and the widespread conception of long range artillery as an instrument of war, it is the shorter range artillery which wins battles. I have only to call your attention to the effectiveness of the French 75's at Verdun to illustrate the vital necessity of having armies equipped with a plenty of mobile field artillery. By field artillery we of course mean the 3 in., 4.7 in., 5 in. and 6 in. 155 mm. guns and the smaller caliber howitzers.

Long range artillery has certain tactical uses in the field, but is very rarely used to fire on men. These tactical uses prepare the way for an offensive operation by destroying railway centers, ammunition dumps, observation towers, bridges and fortified works. It may also be desirable to destroy and interrupt traffic on the lines of communication. A few well-placed shots will accomplish any one of the above objects and then that day's work is done. But the field artillery never ceases to operate in all kinds of fighting. This war has proven the great advantage of having all artillery mobile and capable of being moved swiftly over any kind of road or terrain where there are no roads.

The Ordnance Department early recognized this necessity and produced field pieces on caterpillar mounts. The light ones are capable of moving 15 miles per hour over any road or field, while the heavier howitzers can travel at the rate of 3 miles per hour.

Our forecast, then, of the field artillery of the future will include the light field artillery all mounted on caterpillar mounts or drawn by tractors, and the heavy howitzers and guns on railway mounts.

For seacoast defense, which is an entirely different problem, we have the navy as our first line of defense. It is obvious that no enemy can reach us from the sea unless they first defeat or elude the navy. Granting this accomplished, the next move of any enemy would be to capture our seaports or effect a landing on some suitable point along our coast. Our seacoast fortifications are admittedly the finest in the world. The great extent of our coast line, however, makes it physically impossible to fortify every vulnerable point. Our railway mounts will constitute a mobile seacoast defense, supplementing our permanent fortifications. It is desirable that the entire cost line be divided into zones and batteries of railway artillery assigned to each zone, so that sufficient units could be concentrated at any point attacked. Railroads running parallel to the coast should be extended so that their tracks will cover any strategic points and all places where an enemy might land an expedition.

Closing Remarks

At this point a most dramatic scene was enacted. Major Campbell removed his coat and spoke as follows:

I have received my discharge as an officer in the United States Army, and so remove my coat prepartory to making a few remarks tributary to an officer of exceptional merit serving in the regular army. I am now talking to you as a civilian. Do you know that only 38 per cent of the officers of the regular establishment got to France during the war? Only those men who were associated with these officers know the bitter disappointment these regular army men felt in being forcibly detained in this country. It is hoped that these officers received just recognition for their invaluable work on this side. These men were held here for the simple reason that they were practically the only ones in this country competent to handle the designs and problems of supplying the troops with the necessary equipment. Some of them have received the Distinguished Service Medal. One of the recipients of this decoration was a former chief of the engineering division of the Ordnance Department. This officer, to my personal knowledge, worked day and night, Sundays and holidays, and was a constant source of inspiration to all who worked for him, not only on account of his tireless energy, but for his exceptional ability as an engineer, executive and organizer. I refer to Colonel Jas. B. Dillard. Too much praise cannot be given Colonel Dillard for the

stimulus he inspired in the manufacturers of ordnance material, which resulted in their noble and patriotic response.

I wish also to pay tribute to the manufacturers who so willingly co-operated with the Ordnance Department in all branches of its work. Among these is the American Car and Foundry Company. This concern absolutely placed its entire resources at the disposal of the Ordnance Department. Why, at the inception, in April, 1917, of the first project of railway artillery, the 8-inch mount, one of which is now on exhibition, this company submitted a bid which was 50 per cent below their competitors, with a promised delivery in one-third lass time. In spite of this, the first mount was shipped in half the time promised.

In artillery vehicles such as you have seen on exhibition here they reached at their peak of production a total of 277 vehicles per day, with spare parts aggregating the equivalent of 32 vehicles; thus their production can be stated to have reached 309 complete artillery vehicles per day. Previous to this the best output accomplished in the same kind of equipment was one vehicle per day.

We all know that one of the principal causes of Germany's request for an armistice was the splendid production of war materials in America. This production was only reached by the untiring work and co-operation of manufacturers, railroads, War Department and laborer. As one of the American generals remarked, had the war lasted three months longer the infantry would have to be put on horseback to keep up with the railway artillery.

"Railroad Break-Down" Not Due to Railroad Men

"Too Much Government Interference Caused It," Says W. T. Tyler—Praise for Enterprise of Railway Supply Concerns

W. T. Tyler, director of the Division of Operation of the Railroad Administration, delivered a very interesting address at the Convention yesterday. In the course of his remarks, Mr. Tyler said:

Public Interest in the Railroad Problem

I presume we have all attended the circus "just to take the children," so that I am glad your chairman has explained my reason for staying over in Atlantic City—it has not at all been a hardship, in fact, I tried to have him defer this talk until Wednesday, but he insisted on my coming over this morning. (Laughter).

I presume that the interest of the public to-day is about equally divided between the League of Nations and the railroad problem. I do not know but that we hear the railroad problem discussed among active business men more than we do the League of Nations. They do not expect to have much voice in settling the question of the League of Nations, but they do hope eventually to have a part in on the settlement of the railroad problem, and its settlement touches us all more nearly and the need for it is more immediately pressing, so I believe we can consider the railroad problem in this country at the moment the most important subject of thought and discussion. I believe we can rest assured that the President will carry out his expressed intention to return the roads to their owners at the close of this calendar year. A great deal of concern has been expressed, and is being expressed from day to day, lest this does not afford time for Congress to prepare and pass the necessary enabling legislation. My own opinion is that six months will serve every purpose that would be served by five years. We are not getting from the present method of operation any helpful experience, unless it be the lesson of what not to do. Public operation of privately owned railroads will not work, it is not practicable, and I think practically everyone who is interested and has given the matter study, is satisfied of that fact. I believe the situation is best expressed by the apt remarks of a member of the Senate Committee on Interstate Commerce that it is like trying to teach a man to play the violin by having him practice on the piano. If Congress was given five years in which to take action, very naturally it would defer action until the last six months, because the situation is constantly changing, and it would be a miracle if at any time Congress could enact a law that would serve indefinitely and that would not require changes and modifications as experience taught the need of them, so that one time is as good as another. And the immediate solution is to pass at this time the best legislation Congress can, and then as we operate under it change it as experience shows the need of changing. My own opinion is that the Congress cannot do better than to face about and look to the first year of the war for its guidance as to what should be done for the railroads, and to meet the needs of transportation of this country.

How the Railroads "Broke Down"

We hear a great deal about the railroads, especially of the East, breaking down at that time. I want to say to the railroad men all over this country that the railroads owe no apology for their breakdown or for their failure absolutely and completely to meet the transportation requirements during the first year of the war and before government control was adopted. They broke down in the same sense that the cathedrals of France broke down under artillery fire. With German guns playing on them for days at a time they did break down. The railroads broke down, especially in the Eastern section, where the war activities were greatest because of the multitude of government agencies exercising priority authority, each demanding that the freight for its particular department be moved in preference, and even to the extent of passing out to the railroads the individual car numbers of thousands of cars to be picked out of this great mass of blockaded traffic and brought in.

It was absolutely impossible to meet such a situation. For a long time the railroads had suffered from inadequate rates, and from all manner of hampering regulation. These things together constitute the reason why the railroads were not able to meet transportaion needs during the first year of the war. Under government operation they were able to do it because the government agency placed in charge of the railroads was able to exercise absolute control regardless of all the other government agencies that hammered away day after day for their little part in control of the railroads.

What the Railroad Administration Did

The first thing that the Railroad Administration did was to lock the door on these various governmental agencies and say to the War Department "you tell us

what you want moved and we will move it in our own way. You will get what you ask for and you will get it promptly." Really the very first thing that the Railroad Administration did, however, was to set aside and disregard all the restrictive laws and regulations that had been enacted by both the State and the Federal Government. It was early recognized as impossible to meet the transportation needs of the Government and at the same time follow its regulations, and the regulations of the States fortunately the man placed in charge, Mr. McAdoo, being himself familiar with the government methods and at the same time a man of extraordinary strength, wholly fearless and utterly disregardful of criticism, did apply the strong hand and defeat every effort at interference. He said to not only the central organization at Washington, but passed the word out to the railroads, "you know the transportation game, you know what you ought to do, go ahead and do it and I will stand behind you." That was all that was needed. The only thing needed was to have someone between us and outside interference and the railroads resumed their functions.

Now, it would have been impossible for any central organization or any number of men, no matter how well selected, to have themselves operated all the railroads, brought method and order out of chaos, without this cessation of interference by so many governmental agencies. So I say I think that Congress can do no better than to look back upon the first year of the war and the first four months of Government control to find the solution. If what was done during the first four months of Government control was necessary to enable the railroads to function, similar treatment is necessary now to enable them to go on and meet the requirements of transportation in this country in time of peace and to meet the expansion in business that we are sure to have and that we see coming at this time I should say that the first need is responsible centralized control. That is something that we have never had until we had Government operation. We have had scattered control, but never responsible control; we have had centralized control, but never responsible control. The Interstate Commerce Commission has been much abused, but I do not feel that the criticism is entirely deserved, because the Commission has never been charged with the responsibility for results. It has named a maximum rate after long investigation, and after several roads had become bankrupt, but it never was responsible for the effect of that rate upon earnings. If the railroads went bankrupt under it, the operating officers were considered responsible, and not the officers of the Government who named the rate. So when I say responsible central control, I mean a central body that will have absolute control of the rates and will also be responsible for those rates furnishing adequate returns to enable the railroads not only to meet the transportation needs of the moment, but to improve and build up their properties so as to be prepared at all times to meet just exactly what we met during the war, the maximum of requirements in the way of transportation service.

There should be at the same time a repeal of a great many of the restrictive laws, and the enactment of others in their place, because I think it would be entirely wrong and a most serious mistake for the railroads to be handed back to their owners without regulation of their operation. It is needed, and there will be no satisfactory solution without it.

If I were asked to name the most important benefit accruing from Federal control, I would say that away up at the top of the list stands the methods that have been worked out for dealing with labor. I think it would be a most serious mistake if the corporations in taking back their properties should not work out of the existing boards and agencies for handling labor matters a permanent method, something along the same line, for adjusting labor disputes.

Dealing With the Labor Problem

I have no very clearly defined idea as to just what form the plan should take, but I do want to say that a most serious mistake will be made unless this is provided for, and some definite plan worked out. I think it highly desirable that the officers represented in this meeting give the matter serious thought and consideration. There has been, of course, much complaint about interference of the central administration with discipline, but I believe any one who will stop to consider what the situation would have been if each railroad had been obliged to deal with its labor problems in its own way, will agree that the methods adopted, regardless of whether they are as complete and as perfect as they should be or not, were necessary and did absolutely save the day.

Now, I want to speak just a moment about the convention and its relation to the exhibits. I said on Saturday to the Master Carbuilders that I regarded this supply exhibit as offering to the railroad mechanical officers a post-graduate course in their profession not available in any other way ,and I want to repeat that to you gentlemen now, and to say to you that you will not at all have justified this meeting and your trip here if you do not see every exhibit on the Pier.

Praise for Railway Supply Concerns

The railroad supply man, to my mind, is entitled to a very large measure of credit, for the progres of railroading that has been made in this country, and I want to say furthermore he has accomplished that progress largely against opposition. He has not been met halfway, he has not had the encouragement he should have had, nor the help. I think it is the duty of every railroad officer here to go through the exhibits and not only listen attentively to the demonstrator but to give him your suggestions. He is entitled to that, and out of all that he gets unquestionably some will be valuable to him. I do not think there is any question that we have made greater progress in this country in the development of the art of railroad transportation than has been made in any other country on the face of the globe, and as I say, it is largely due to the supply man. It has not been a work of philanthropy, at all, it has been a business proposition, but it has been the result of foresight.

I know of a number of railroads in this country that encourage initiative and inventive genius, but a great many of them tie a string to it. If you produce something of value, the fact that you are on the payroll of that company gives it the right to use it without paying you for it. I think this policy is wrong. I think it has proceeded from an entirely wrong viewpoint, and if it were not for the supply man who stands ready to take whatever the inventor can work out and pay him for it, we would not have had this progress. The supply man may recognize that the appliance is not perfect and is even of doubtful value, but he always realizes that no other action will stimulate the interest, not only of that man, but of others in the same line of work, to use the inventive genius they have and to go along improving, and the supply man has prospered, not at all beyond his due, because he, after all, has carried the financial burden, and he realizes that a very large number of the appliances that he invests his money in must fail, but he keeps right along, trying again, buying something today.

perfecting it and discarding it to-morrow when he sees something that is a little better. For these reasons they are entitled to all you and I can do to help them along in that direction, to justify what they are trying to do, and so I say to you my own idea about the convention is that even if you find it necessary to stay here and transact your business after the exhibit closes, such a course would be preferable to neglecting one single booth on this pier.

I was introduced here to-day as the Director of the Division of Operation. When you meet next year there will perhaps not be a director of the Division of Operation. I hope at that time I may be asked to come down here again simply as one of yourselves to meet with you, listen to your discussions and avail myself, as I have on this occasion and as I propose to do during the next couple of days, of what there is to learn from the railroad supply exhibits.

Meeting of Railway Electrical Engineers

THE SEMI-ANNUAL CONVENTION of the Association of Railway Electrical Engineers was held at the Hotel Dennis on Monday, June 23. The opening session was called to order at 10 A. M. by President J. E. Gardner, of the Chicago, Burlington & Quincy.

Jos. A. Andreuceti, secretary and treasurer of the association, presented a brief report in which the excellent financial condition of the association was shown. Mr. Andreuceti explained that it had not been the thought to provide an extensive program for this meeting, but that it was intended to provoke discussion to assist the members of the several committees in presenting more comprehensive reports at the annual convention in the fall.

Although the meeting was held ostensibly for the purpose of hearing the progress reports of the committees, one report was presented in completed form. At the annual convention last October the Committee on Electric Headlights was instructed to make a more extensive study of this subject and present its findings at the June meeting. The subject is a particularly live one at this time and the report was presented to a large and appreciative audience.

In substance the report is based upon facts brought out by a questionnaire sent to a number of roads sometime ago to obtain information as to their practices. Although there is apparently a decided lack of uniformity in the headlight practice on the different roads there was sufficient information gathered from the questionnaire to enable the committee to prepare an interesting and instructive report. All phases of the headlight question were considered, including the conduit runs, wiring, switches, lamps, receptacles, etc. The committee was highly complimented on the excellent report it had prepared, although it was very evident from the lengthy discussion which followed that the time has not yet arrived when electric headlight equipment can be permanently standardized. The practice has changed so rapidly in headlight equipment that it has been exceedingly difficult to fix upon definite and permanent standards. There is every reason to believe that many other developments will take place before all of the different parts of this apparatus can be permanently standardized. In fact, it is exceedingly doubtful if it would be possible to standardize all equipment so that all roads would use the same standards. Nevertheless, the report of the committee is full of important recommendations which will serve as an excellent basis for present practice, and as such, it was accepted by the association. It was, however, referred back to the committee again for its further consideration in order that any new developments might be included when the report will be again presented at the annual meeting of the association in October.

In view of the fact that the report embodies an excellent resumé of electric headlight practice at the present time it has been accepted as such by the Mechanical Section of the American Railroad Association and will be presented in its entirety at the meeting of this association on June 24.

The first report presented at the afternoon session was the progress report of the Electric Headlight Handbook Committee. It is the thought of this committee to prepare a handbook similar in all respects to the Car Lighting Handbook which was compiled last year and which so satisfactorily filled the requirements in the maintenance of car lighting apparatus. Special emphasis was placed upon the importance of preparing the headlight handbook, so as to include complete information concerning the theoretical operation of the various equipments.

The work of the Committee on Illumination was assigned to three sub-committees, namely, Sub-committee "A," car illumination; Sub-committee "B," on shop illumination, and lighting, etc. ,and Sub-committee "C," on lamp specifications. In answer to the question as to what might be expected in the way of increased efficiency of lamps, L. S. Billau, of the B. & O., seemed to be of the opinion that there was little to be expected in the way of reducing current consumption by increased efficiency of lighting units ,as the tendency at the present is toward increased use of lamps with a corresponding increase of current.

E. Lunn, of the Pullman Company t,hought that some attention should be given to the artistic design of the lighting fixtures and that this question was at present under consideration by the Pullman Company.

In the matter of lamps for use on extension cords in shops, the practice of using carbon filament lamps, while desirable in view of its more rugged construction, will probably be eventually supplanted by tungsten lamps, due to the difficulty of securing a good grade of carbon lamps. It was suggested by J. L. Minick, of the Pennsylvania Railroad, that auto transformers might be used on 110-volt circuits, and by this means reduce the voltage on the lamps to 32 volts . Tungsten lamps of much larger filament can be used with the corresponding rugged construction. The more general opinion of the members, however, was that the matter should be taken up with the lamp manufacturers, with the idea of getting them to develop a tungsten lamp that would be sufficiently rugged to withstand use on extension cords.

The Committee on Electric Arc Welding in its progress report expressed the intention of going into the matter of arc welding in a most thorough manner, insofar as the matter is applicable to the repair of locomotive parts and in the numerous other fields on the railroad where welding can be carried on to advantage.

E. Wanamaker, of the Rock Island Lines, read the report of the Committee on Electrification. The committee expressed its desire to secure from as many of the members as possible all the information on this subject that is available. There is undoubtedly an increasing interest being taken by railroad managements in electrification projects, and it is information along this line that the committee wishes to be in a position to supply those roads that are logically interested in electric traction.

L. S. Billau read the report of the Committee on Train Lighting Equipment and Practice. This report covered

a number of temperature rating specifications with reference to axle generators. These specifications represent the first steps in the standardizing of the ratings of axle generator equipment ,and it is hoped that future specifications may be extended to include all parts of axle generator apparatus which may be properly assigned specified ratings.

The Committee on Compiling Costs for maintenance of Head Light Equipment expressed its intention o fseeking the assistance of the various roads as to their present methods of keeping cost records for maintenance.

Registration, American Railroad Association, Sec. III, Mechanical

Allstrand, H. P., M. M., C. N. W., Marlborough.
Andrewcetti, Jos. A., A. E. E., C. & N. W., Dennis.
Band, R. W., S. S., B & M., Monticello.
Barclay, F. P., S. M. P., I. C., Ambassador.
Bardo, C. L., Gen. Mgr., N. Y., N. H. & H.
Barton, T. F., M. M., D., L. & W., Traymore.
Beatty, D. H., Supt. of Safety, Southern.
Bennett, W. H., M. M., Pa., Traymore.
Bickford, S. A., M. M., N. Y. C., Chelsea
Bingaman, C. A., M. E., P. & R, Wiltshire.
Black, W. C., M. M., N. Y. C. & St. L., Ambassador.
Blunt, James G., Gen. D. R., American Loco. Co., Marlborough.
Booth, J. K., M. M., B. & L. E., Ambassador.
Borell, E. A., P. & R., Wiltshire.
Brodman, R. W., Gen. Fore. Elec. Equip., L. I., Dennis.
Burns, Jno., M. M., C. P., Haddon Hall.
Gallaway, A. K., M. M., B. & O., Haddon Hall.
Cherry, W. Y., M. M., G. R & I.
Chilley, Jos., S. M. P., N. Y. C., Marlborough.
Gleason, M. A., B. & O., Apollo.
Cole, Thos. J., M. M., Erie, Arlington.
Daley, W. W., M. M., New York, Ont. & West., Chalfonte.
Davey, Thos. S., Erie, Arlington.
Davis, J. E., M. M., Hocking Valley, Haddon Hall.
Depue, G. T., S. S., Erie, Haddon Hall.
Drury, M. J., Sup. Shops, A. T. & S. F., Traymore.
Duga, G. A., M. M., P. & R., Haddon Hall.
Edmondson, W. G., Eng M. P., P. & R., Galen Hall.
Edmonds, Geo. S., S. S., D. & H., Ambassador.
Ennis, J. F., A. E. R. S., N. Y. C., Galen Hall.
Flanagan, M., M. M., C. & O., Bothwell.
Freedman, L. D., S. S., S. A. L., Westminster.
Fries, A. J., Asst. Supt. M. P., N. Y. C., St. Charles.
Gardner, G. Clinton, G. F. M. P., Penn, Chalfonte.
Gardner, Henry, S. A. & S. A., B. & O., Chalfonte.
Gaston, J. H., Montgomery Ala., Breakers.
Glenn, J. H., R. B. F., Pitts. & West Va., Sterling.
Greenwood, B. E., S. S., S. A. L., Osborne.
Gill, C. A., S. M. P., B. & O., Marlborough.
Haig, M. H., M. E., Santa Fe, Traymore
Hanlin, J. J., M. M., S. A. L., Berkshire Inn.
Hartigan, Bert, Genl. Fore., Rutland, Arlington.
Hassett, M. W., M. M., N. Y. C., St. Charles.
Haupt, H. H., A. E M. P., Pa.
Hoke, H. A., Acting Asst. Mech. Eng., Penn., Morton.
Kothe, C. A., Gen. Ins. of Maint., Chalfonte.
Hunter, H. S., M. M.
Irvin, I. B., G. P., P. S. & N., Terminal.
Irvine, William, M. M., U. P.
Jackson, W. S., M. S., Erie, Haddon Hall.
Jennings, J. F., Div. M. M., M. C., St. Charles.
Karibo, J. J., M. M., C. C. C. & St. L., Alamac.
Keenan, C. E., Midvale Steel & Ordnance Co., Marlborough.
Kelly, S. R., M. M., So., Ambassador.
Kendrick, J. P., M. M., B. R. & P., Osborne.
Kinnear, C. W., Asst. Gen. Store., Pa.
Kuhn, B. F., A. M. M., N. Y. C., Arlington.
Laux, J. P., M. M., L. V.
Lawes, T. A., M. E., N. Y. C. & St. L., De Ville.
Leinbach, H. W., Elec. Eng., W. & S. E., Dennis.
Leyonmark, J. H., M. E., C. & A., Brighton.
Ligon, J. F., M. M., Ashland Coal & Iron Ry.
Lipetz, A. I., Russian Rys., Marlborough.
Little, J. C., M. E., C. & N. W., Traymore.
Mauldin, S. R., M. M., I. C., Whittle.
McGahey, R. F., M. M., Washington Southern, St. Charles.
MacBain, D. B., Asst. G. M., N. Y. C., Blenheim.
Mahar, Thos., M. M., N. Y. C., Traymore.
Martin, A. W., Supt. Shops, C. C. C & St. L., Alamac.
Meade, P. J., M. M., A. C. L., Chalfonte.
Meesley, F. P., Div. M. M., M C., St. Charles.
Mill, George, R. F. E., P. & R., Netherlands.
Mill, J. F., M. M., W. & L. E., Dennis.
Minick, J. L., For., Penn.
Montgomery, M., Retired M. M., C. R. R. of N. J., 206 Atlantic Ave.
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Mullen, D. J., S. M. P., C. C. C. & St. L., Alamac.
Munson, J. G., Cedar Rapids & Iowa City, Bingham.
Mullinix, S. W., S. S., C., R. I. & P., Dennis.
Murphy, F. K., A. S. M. P., C. C. C. & St. L., Alamac.
Nelson, C. B., Ind. Harbor Belt, Chelsea.
Nelson, F., N. Y., N. H. & H.
Nevins, B. E., M. M., Virginian, Breakers.
Parker, H. H., Norfolk & Portsmouth Belt, Sterling.
Parsons, C. F., M. M., N. Y. C., St. Charles.
Parsons, J. G., S. S., N. Y. C., St. Charles.
Pfahler, F. P., C. M. E., U. S. R. R. A., Traymore.
Pattison, R. C., M. E., W. & L. E., Dennis
Pickard, F. C., M. M., D., L. & W., Traymore.
Quereau, C. H., Supt. Elec., N. Y. C., Marlborough.
Robb, G. W., G. S., Co. of Canada, Breakers.
Robinson, M., D. M. M., G. C. & S. F., St Charles
Richmond, J. A., M. M., C. T. H. & S. E, Traymore
Roesch, F. P., Ambassador.
Rolston, W. E., Supt. P. & E., C. L. S. & S. B.
Rusling, W. J., P., B. & W.
Sample, W. H., Gen. S. M. P. & C. D., G. T, Chelsea.
Sechrist, T. O., M. M., C., N. O. & T. P., Ambassador.
Small, J. W., Staff Officers Mech., S. P. A. A., Marlborough.
Smith, E. J., M. M., A. C. L., Lexington.
Smith, J. G., M. M., West. Md. Ry., Monticello
Snyder, W. H., M. M., N. Y. S. & W., Elberon.
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Stohlberger, P. J., M. M., Atlantic City.
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Symons, J. E., D. M. M., G. C. & S. F., St. Charles
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Tawse, Robt., S. M. P., D., T. & I.
Taylor, C. S., M. M., A. C. Line, Lexington.
Thibaut, Geo., M. M., Erie, Osborne.
Thompson, F. L., Chief Eng., I. C.
Tillett, C. H., Asst. Sig. Eng., G. T.
Towne, W. J., Asst. Gen. Man., C. & N.
Turner, Amos, M. M., L. V., Lexington.
Turner, J. S., Honorary Man, Marlborough.
Turtle, J. A., M. M., U. P., Chalfonte.
Van Winkle, J. L., Supt., Central Indiana.
Wagstaff, Geo., American Arch Co., Chalfonte.
Wall, H. S., M. Supt., A., T. & S. F., Ambassador.
Wallace, F. C., M. M., Erie, Deville.
Wanamaker, H., S. S., N. Y. C., Traymore.
Warthen, H. J., S. M. P., R. F. & P., Seashore
Watson, Samuel, D. S. M. P., N. Y. C., St. Charles
Webb, E. R., Div. M. M., M. C., Haddon Hall.
Webster, H. D., Eng., M. P., B. & L. E., Chelsea
Wiggin, C. H., S. M. P., B. V. M., Chelsea
Wood, Walter D., S. M. P., Mount Hope Mineral, Breaker.
Woodbridge, H. C., Supr. Fuel Cons., U. S. R. R. A., Strand.
Wray, R. W., M. M., Penn.
Wyman, Geo. A., M. M., B. & M., Monticello.

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Anderson, B. W., Asst. Supt. M. P., C. M. & St. P., Traymore.
Anderson, J. B., C. C. to Asst. A. M., P. R. R., Runnymede.
Ballda, F. F., Supt. Shops, N. Y. N. H. & H.
Barrett, A. D., Asst. M. M., C. C. C. & St. L.
Beck, H. J., Gen. Loco. Insp., P. & R., 2219 Atlantic Ave.
Bennett, M. D., Asst. Mgr., N. & St. L., Dennis.
Bickford, S. A., M. M., N. Y. C., Chelsea.
Boedemer, C. J., Asst. Supt. Mach., L. & N., Ambassador.
Bogdanovitch, Ignaty W., M. E., member of Rus. Mis.
Boorzhinsky, Eng. of M. E., Russian Mis. of Ways.
Boucher, E. F., Gen. For., Wash. Term., Whittle.
Brenholtz, Thos. E., Draftsman, P. & R.
Britt, F. W., N. Y. C., Pennhurst.
Bronikovsky, Michael M., M. E., Russian Mis. of Ways.

Brunell, J.E., Ch. Loco. Insp., Penn., Sterling.
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Butler, F. A., M. M., B. & A., Chalfonte.
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Caley, G. W., M. M., N. Y. C., Fredonia.
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Clark, Juan M., Loco. Inspr., Cuba Cane Sugar, Dennis.
Clemson, L. C., M. M. Insp., Pa.
Cloggett, Meyer, Asst. to Direc. Gen. of Rys., U. S. R. A., Traymore.
Coffman, Allen B., Asst. Elec. Eng., P. & R., Wiltshire.
Coffman, B. J., Atg. Mech. Eng., R. F. & P.
Col, B. N., Ch. Clrk. to Asst. Fed. Mgr., Southern, Iroquois.
Cooper, F. E., Supt. Shops, B. & O., Osborne.
Couch, R. F., M. M., M. D. & G., Osborne.
Cow, Alberto, Representative, Cuba Cane Sugar Corp.
Craddock, R. B., Ch. Boiler Inspec., Southern.
Cramer, C. B., M. M., Wash. Term., Whittle.
Cramer, H., M. M., Seaboard Air Line.
Crawford, M. R., Gen. Fore., C. R. of N. J., Louvan.
Culver, C. H., Super. Mach. & Tools, B. & O., Craig Hall.
Cunningham, L. S., Draftsman, B. & O., Marlborough.
Dailey, E. B., Corporate Mech. Eng., S. P., Traymore.
Dale, L. E., Supr. Office of Asst. to Gen. Mgr., P. R. R.
Dawson, V. N., Trav. Strkpr., U. S. R. R. A.
Demarest, G. L., Gen. For., C. R. R. of N. J., Stehling.
Dampman, Charles P., Supvr. Fuel Conserv., P. & R., Strand.
Davis, A. J., M. M., Erie, Alamac.
Davis, B. H., M. M., D. L. & W., Lexington.
De Salis, J. H., M. M., N. Y. C., Pennhurst.
Dickert, C. L., Supt. Shops., Cent. of Ga., Schlitz.
Dickerson, T. B., Supt. Lo. Shops, C. R. R. of N. J.
Dillon, E., Asst. M. S., Central Vermont, Osborne.
Dolingoff, Alexis J., Min. Eng., Member of Russian Mis.
Easterly, H. R., Ch. Lo. Insp., U. S. R. R. A.
Edge, Senator Walter E., U. S. Senator.
Edwards, J. B., M. M., Newberry & Laurens, Continental.
Ellington, R. F., R. F. E., Southern, Borton.
Ellinsky, S., M. E., Russian Gov. Rys., Grand Atlantic.
Elliott, R. H., Genl. Elec., W. J. & S., Elberon.
Enockson, H. A., R. H. Fore., C. St. P. & M. & O., Marlborough.
Enockson, J. O., Supt., M. P. & M., Marlborough.
Estevez, Santiago, Gen. Mgr., Cardenas American Sugar Corp.
Farrington, T. B., M. M., P., Ambassador.
Feeny, B. J., Supv. Fuel Con. Sec., U. S. R. R. A., Ambassador.
Fellows, P. S., Foreman Mach. Shop.
Forbes, H. W., For., Erie, Blackstone.
Fravel, George B., M. M., Penna. L. W., Dennis.
Fuller, E., M. M., So., Dennis.
Funnell, Walter, Mach. Shop Fore., N. Y. C. & W., Netherland.
Gardner, J. E., E. E., C. B. & Q., Marlborough.
Gaughan, Richard, Fore., C. R. R. of N. J., Arndale.
Gaun, J. G., Reg. Store Ins., Allegheny Reg. Pur. Com.
Geoghegan, J. T., M. E., Southern, Chalfonte.
Gilleland, G. W., M. M., S. A. L., Berkshire.
Gilles, W. H., Genl. Air Brake Inspr., L. I.
Gorman, T. F., M. M., Erie, Chelsea.
Good, G. W., Supvr. Pcwk., M. C., Shelburne.
Good, Harold, M. C., Shelburne.
Graef, C. S., Supr. Elec. Weld., B. & O., Alamac.
Grimes, L., M. M., I. C., Ambassador.
Hall, John M., Asst. Chief Insp., Inters. Com. Com., Blackstone.
Harriman, N. F., Eng. of Tests, U. P., Traymore.
Hassett, J. C., M. E., N. Y., N. H. & H., Osborne.
Hatakeyama, I., Professor, Japanese Waseda University.
Hedeman, W. R., Leading Dfmn., B. & O., Arlington.
Hendricks, L. W., Supt. of Shops, N. Y., N. H. & H.
Hennessy, B. J., Ch. Boiler Insp., N. Y. C.
Hertzler, S. H., Special Engineman, Pa., Lyric.
Higgs, G., Asst. R. F. E., C. R. R. of N. J., Levan.
Hodge, Col. Henry W., U. S. A.
Holder, J. A., Genl. Master Boiler Maker, S. A. L., Osborne.
Hopkins, J. W., M. M., Pa. Lines West, De Ville.
Houser, G. A., Spec. Agt. Legal Dept., Penn., Pennhurst.
Houser, W. M., Penn., Pennhurst.
Howley, T. F., S. L. O., Erie, Schlitz.
Hudson, W. R., Gen. Mgr., A. B. & A., A. & W. P., Ga. C. W. & C.
Hunt, Robert, Chief Mech. Dfts., S A. L., Chelsea.
Hurst, G. E., M. M., P., Chalfonte.
Hustch, F. T., M. M., Pa., Dennis.
Ingram, M. D., Supt. Mach., No. Okla. & Gulf, Holmhurst.
Jennelle, C. M., Asst. Gen. For., N. & W., Chalfonte.
Jones, W. C. Lyster, Chf. Draft., Penn.
Juneau, C. G., Gen. Supvr., C. M. & St. P., Traymore.
Keagyand, C. O., M. M., P. R. R., Strand
Keiling, K. E., Chief Clerk, N. Y. C., Traymore.
Kelly, C. W., Fore. Blacksmith Dept., C. R. R. of N. J., Sterling.
Keen, C. C., Engr. W. of S., American Rys.
Kern, M., Upholsterer For., B. & O., Strand.
Keyes, R. W., Asst. Chief Matl. Insp., N. Y., N. H. & H., Strand.
Kleinhans, F. J., Car. Acct., Interstate Tank Car Corp., Chelsea.
Knott, F. W., M. M., Seaboard Air Line, Osborne.
Kokawa, M., Asst. Resident Repr., Japanese Govt. Rys., Marlborough.
Laugton, G. H., Shop Supt., Virginia, Breakers.
Learner, M. F., Asst. to Chief of Ry. Dept., Russian Gov. Rys., Blackstone.
Lee, Elisha, Fed. Mgr., Pa.
Lenard, W. L., P. R. R.
Leonard, W. W., Super. Car Lighting, B. & O., Hayden.
Levin, V. Z., Chief Loco. & Car Inspt., Russian Gov. R. R., Blackstone.
Linthicum, Frank, Road For. of Eng., Pa.
Lipetz, A. I., Chief Russian Ry. Mis., Russian State Rys., Marlborough.
Logan, G. H., Gen. For., C. & N. W., Traymore.
Lorcbun, A., Gen. R. H. F., C. R. R. of N. J., Levan.
McCann, J. R., Chief Clerk S. M. P., Milling & Lake Erie, Elberon.
McConnaughy, H. G., Secy., Nat. Elec. Light Assn., Shelburne.
McDonnell, D. V., M. M., Pa., Dennis.
McKay, C. D., Chief Loco. Insp., N. P., Breakers.
Manderson, A. R., Asst. S. M. P., Maine Cent., Alamac.
Milliken, Jas., Cal. Eng., Military Railways, Brighton.
Moist, H. I., Gen. For., R. F. & P., Marlborough.
Moll, R. H., R. F. E., P. & R., Netherlands.
Montague, W. T., M. M. Asst. to Gen. Mgr., Pa., Dennis
Moore, Wm, M. M., Erie, Haddon Hall.
Moran, W. F., M. M., B. & O. West, Alamac.
Morton, B. C., Draftsman, B. & O., Arlington.
Mullen, M. E., M. M., B. & O., Schlitz.
Murphy, J. W., G. Fore., B. & A., St. Charles.
Murphy, T. J., Asst. to Pur. Agt., B. & O., Strand.
Needham, R. J., Mech. & Elec. Eng., Grand Trunk.
Nelson, C. B., M. M., I. H. B., Chelsea.
Nevins, B. E., M. M., Virginian.
Newman, W. A., M. E., C. P. R., Marlborough.
Norton, A. M., Equipment Pilot Eng., B. & O., Arlington.
Norton, C. H., M. M., Erie, Arlington.
Orghidan, Constantine C., Roumanian Gov. Com., Traymore.
Oviatt, Harold E., Chalfonte.
Owens, W. H., M. E., Southern, Borton.
Page, A. N., L. V., Arlington.
Page, Earl, L. V., Arlington.
Patterson, D., M. M., N. So., Osborne.
Pearce, E. S., M. E., C. C. C. & St. L., Alamac.
Peddle, C. R., Asst. Pur. Agt., Penn., Traymore.
Pie, E. F., M. Draft., Penn.
Pohlman, Wm., Gen. Fore. Loco. Dept., N. Y., O. & W., Netherland.
Pribble, B. S., C. C. to S. M. P., R. F. & P. R. R., Wiltshire.
Pugh, A. R., Gen. Air Brake Insp., S. A. L., Osborne.
Ramsdell, F. H., M. M., Maine Cent.
Randolph, V. C., As. Sup. Fuel Cons., U. S. R. R. A., Schlitz.
Rhodes, Robert S., Ch. Draft. Elec. Dept., N. Y. C., Runnymede.
Rice, Frank J., Chf. Lo. Insp., U. S. R.R. A.
Richardson, W. P., Sen. M. E., I. C. C., Pennhurst.
Richardson, Laurence, Asst. Supvr. of Equip., U. S. R. R. A., Haddon Hall.
Riegler, Fred, Wheeling & Lake Erie, St Charles.
Robb, E. H., C. D., Long Island, Homestead.
Roberts, R. D., Leading Mech., Florida East Coast.
Robey, A. A., Asst. Ch. Clerk to Staff, S. I., Arlington.
Robsnson,, J. J., M. M., So. Ry., Osborne.
Roosevelt, Franklin D., Asst. Secy. of Navy, U. S. Navy.
Rosenberg, Chas. R., C. C. to Div. Pass. Ogt., Penn.
Russell, Harry B., For. Eng. House, P. & R., Haddon Hall.
Russell, Walter L., Genl. For., Reading, Speidles.
Starke, Aubrey H., Supr. of Loco. Rpr., U. S. R. R. A., Chalfonte.
Sands, Edwin A., Div. Acc., B. & O., Bouvier.
Siebert, Frank T., Fed. Insp., Inter. Com. Com.
Sdigletch, W. L., Safety Super., Mech., Southern, Osborne.
Siegfried, M. A., Trav. Fire., Central R. R. of N. J.
Singleton, A., Gen. Store., Hocking Valley, Haddon Hall.
Simons, A. M., Road Fore. of Eng., P. S. & N., Reading Ter.

Conventionalities

H. J. Small, well-known railroad man, now a resident of San Francisco, could not attend the convention this year on account of illness.

J. E. O'Hearne, formerly with the mechanical department of the Chicago & Alton, was recently seriously injured in a street car accident in Denver, Colo.

It is a matter of regret to many that W. L. Kellogg, formerly of the Pere Marquette, is ill and will not be here this year. Mr. Kellogg lives in Denver, Colo.

M. Kokawi, resident inspector of the Imperial Government Railways of Japan, with headquarters in New York, arrived Saturday and expressed his amazement at the first convention he has ever attended.

F. I. Marriott, chief draftsman of the Chesapeake & Ohio is ,known as the human calculator. It is said that he can "figger" the number of tubes in a boiler from the width of the running board.

The many friends of Mrs. Stanley Midgley will note her presence this year after an absence of some six years. Prior to that time her record of ten consecutive conventions is a good one.

Many friends of Mr. and Mrs. J. F. Dunn will be pleased to hear of them. They are in California with their daughter, Miss Edna Dunn, and are visiting another daughter, Marganeret, whose husband is in army service in San Francisco.

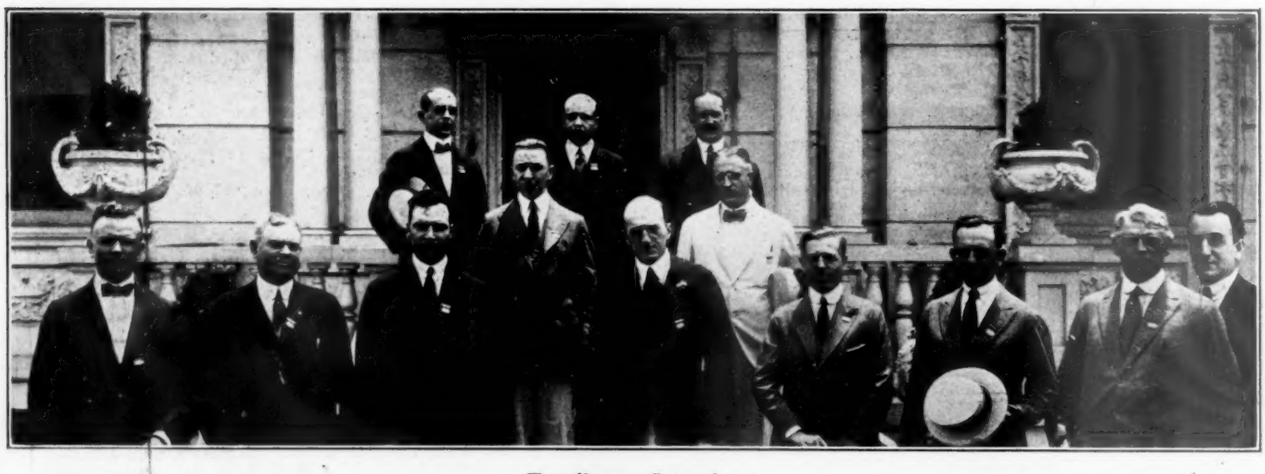
Probably the oldest guest at the conventions is the mother of F. B. Ward, of the Elwell-Parker Electric Company. Mrs. Ward has recently celebrated the ninetieth anniversary of her birth. She is enjoying the conventions each day on the pier.

"Big Dan," Assistant Superintendent of Motive Power of the Denver & Rio Grande, in introducing his little brother, Frank Cunningham, of the Standard Stoker Company, says, "We're triplets. He's one of them; I'm the other two."

Alfred B. Carhart, vice-president of the Crosby Steam Gage and Valve Company, of Boston, came here to drown his sorrows in the Atlantic and incidentally to look over the convention. Mr. Carhart's disconsolate frame of mind was caused by the outcome of the Yale-Princeton baseball game which he attended yesterday. Princeton "blew up" in the fifth inning.

W. T. Tyler, Director of Operation, U. S. R. A., and Mrs. Tyler

Miss Irene M. Dunne, who was the soloist of the sacred concert given in the Exchange of the Marlborough-Blenheim Sunday afternoon, is a young soprano of remarkable promise. She completed her last year at the Chicago Musical College just before coming here. She sang with the Marlborough-Blenheim Orchestra Sunday afternoon, and everybody enjoyed her singing greatly. Miss Dunne's home is at Madison, Ind. She is a friend of Mr. and Mrs. L. E. Jones and Fritz Ernest, of the American Steel Foundries, and has been visiting them while in Atlantic City.



Enrollment Committee

Top Row, Left to Right: Harry Jacques, F. H. Smith, William S. Edgar. Second Row: F. V. McGinness, J. A. Stevens. Bottom Row: S. Inglis Leslie, George A. Barden, L. D. Mitchell, G. H. Gayetty (Chairman), S. H. Campbell, Joseph E. Brown, George W. Denyven, Gilbert E. Ryder.

Donald R. MacBain, of the New York Central Lines West comes to the convention this year as assistant general manager instead of superintendent of motive power, having been promoted a short time ago. Mr. MacBain had been superintendent of motive power nine years.

Mr. and Mrs. E. P. Welles are accompanied this year by their son, Edward, who paid the convention the compliment of preferring to come here from Yale, where he is a student, to going to the boat races. Mr. Welles is president of C. H. Besly & Company, of Chicago.

Center, Mrs. W. T. Tyler, wife of the Director of Operation, U. S. R. A., and her two nieces, Misses Veronica and Lucile Ermatinger

William K. Krepps, of the Crucible Steel Company of America, who was chairman of the Entertainment Committee one year and a member of this commitee for six conventions, received a telegram yesterday from President-elect Carr, of the R. S. M. A., appointing him chairman of the Entertainment Committee for the 1920 conventions.

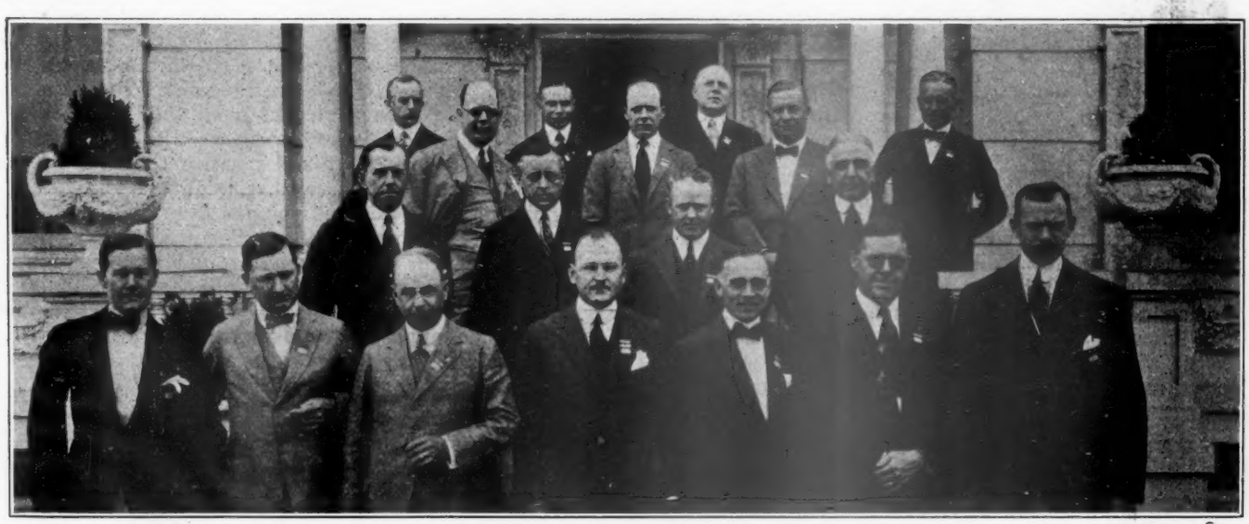
J. F. Graham, superintendent of motive power of the Southern Pacific, could not be present on account of illness. Mr. Graham has had an attack of influenza, but is recovering. Mr. and Mrs. Graham, well known to conventionites, are residents of Portland, Oregon.

Mention was made in Mondal's issue of the *Railway Age,* regarding the celebration of "Bob" Fisher's seventieth birthday." This statement was somewhat incorrect. Mr. Fisher is celebrating, but not his birthday. He will be 74 years old this fall and will then retire from service with the Bass Foundry & Machine Company, after 55 years' service.

Nelson B. Gatch, of the Chicago Pneumatic Tool Company, received a promotion during the convention. He was yesterday named as manager of sales of the New York district. Mr. Gatch was a captain in the air service and, upon receiving his discharge in February, joined the forces of the Chicago Pneumatic Tool Company as district manager in the Minneapolis territory. He later on held the same position in Chicago.

J. H. Young, senior assistant director of operations of the Railroad Administration, accompanied by Mrs. Young and their daughter, Miss Jeannette, are visitors at the convention. Before the adoption of Government control Mr. Young was president of the Norfolk Southern. He became federal manager of the Norfolk Southern and later also of the Virginian, which position he held before he was promoted to his present office.

When Major Leonard J. Hibbard appeared this year on the Pier he received as cordial a welcome as any man could possibly be given. And well he might. Enlisting in the French aviation service early in 1916 he flew during five months of that year. In 1917 he joined the American forces and was assigned to the first division as first lieutenant. In may of 1918 he was promoted to the captaincy of Company C, First Regular Engineers. While brigaded with the British forces in November of 1918 he was wounded, and again received wounds at Cantiguy, at St. Mihiel and in the Argonne. Major Hibbard's wounds consisted of two broken legs, a machine gun bullet through the wrist and minor injuries. For nine years Major Hibbard served on the Entertainment Committee of these conventions.



Entertainment Committee

Top Row, Left to Right: W. W. Melcher, W. H. Oliver, Langley Ingraham, Worcester Sargent, Ellsworth Haring, W. M. Wilson and L. O. Cameron. Second Row, Left to Right: J. M. Brown, A. C. Moore, George A. Nicol and J. L. Paxton. Bottom Row, Left to Right: W. K. Krepps, N. C. Naylor, L. B. Sherman, E. H. Bankard, Jr., J. E. Slimp, H. E. Passmore and R. J. Himmelright.

The Man Who Saw

The Efficient Switchman

The air brake man had just returned from a tour of the perturbed realm of Don Venustiano Carranza.

"You know," said he to The Man Who Saw, and the suuply man who said he was sitting up nights studying Spanish, "I learned how the Mexicans uncouple air brake hose down there. They pull out a knife and cut the hose in two—its quicker, and they don't understand the hose coupler anyway."

"They do that here," said the M. C. B. from Kansas. "The only difference is that we don't use a knife."

A Tribute From Darktown

Superintendent of motive power, master mechanics, other locomotive men and the convention attendants in general are not the only ones who have visited and paid tribute to the Pennsylvania Railroad's latest masterpiece—the monster simple Mallet locomotive illustrated and described in the *Daily Railway Age* for Monday, the 23rd.

A delegation from Darktown was in attendance the other day and the Man Who Saw heard this little compliment from one of the colored admirers, "My, my, dat sho' am some injun. Hook her on to Atlantic City and she'll pull her right on up to Philadelphia."

One Millionth of an Inch

It may be new to many to learn that seasoning—air seasoning from two to five years—is necessary before steel is in a fit condition to be used in the construction of certain machines and tools. To prove the truth of his statement to The Man Who Saw, the fine tool manufacturer produced a Hoke precision gage and explained that it is the most precise instrument ever produced by the hand of man. It is accurate to one millionth of an inch—count 'em. And he said one millionth is just as easy to measure as one thousandth. All you have to do is to catch a sunbeam and measure your work by it to prove it.

That is how it came about that seasoned steel—the time and air seasoned article that is steady and settled in its ways—must be used in the construction of certain instruments.

Signs of the Times

One of his friends who has cultivated Cuban, Mexican and South American railroad men to a considerable extent, called The Man's attention to the significance of the fact that among the visitors here this year are two well known Cuban locomotive men, one of whom is in charge of 110 locomotives; two master car builders of Cuban railroads; two locomotive superintendents of important Cuban lines; a native general manager of Porto Rico's railroad system, and a distinguished Mexican who represents in the United States the purchasing interests of the National Railways of Mexico.

"Two of the Cubans," said the friend, "were amazed at what they saw at this, their first convention. They said that they took a chance on coming here in spite of the report that it would cost them $40 a day. "Why," added the friend, "doesn't somebody start something that will induce a representative showing here from Latin America every year? Why not arrange for their reception?"

The Man remembered a large recent purchase made by a man on this list and learned that after the order was concluded, two vertical turret lathes were added as a result of the visitor's attendance at the convention.

"Yes, why not?" said The Man.

It seemed that the arrival of the Latin Americans shadowed events which might be worth encouraging.

The New Mail Car

Rumors in Poseyville had it that the Poseyville & Northwestern Railroad had ordered a mail car. As a consequence the usual daily committee of prominent citizens who considered it their sacred duty to see that the wheezy little train arrived safely, was considerably increased.

Finally she arrived and was given a reception and a write-up in the Daily Taddle-Tale.

"Well," said the well-known motive power accountant, who was telling the story to The Man Who Saw, "Everything seemed clear about the new car except the strange hook across one of the doors.

"What is that hook for?" inquired the druggist.

"It's to keep the door shut," ventured the grocer.

"You're both wrong," asserted the editor of the Taddle-Tale, "that's the mail hook. It grabs the mail as the train rushes past a station."

"Well, Andy," said the grocer, "don't you send any more eggs by parcel post."

The Builder of Men

The mechanical engineer from the southwest turned the pages of a railway mechanical engineering paper with unconcealed affection.

"I have a fine drafting room," said he. "Whenever I hire a new man for my department my instructions to him include the following:

" 'We are buying your time which is eight hours a day. In return therefore, we give you eight dollars—a dollar an hour. The money we pay is real money; its value doesn't fluctuate. It is never discounted and represents full value. In return for this money we expect eight dollars worth of your time, which is eight hours a day of conscientious concentration on our work. We no more expect you to discount the value of these hours than you would have us deduct from your pay check.

" 'When the work slackens, instead of killing your own time at a dollar an hour and perhaps the time of another high-priced man as well, I want you to go to the book shelf and get a bound volume of a railway mechanical engineering paper and dig something out of it, which, from your observations around here, you think would benefit us by its adoption. I don't care what it is, just so its worth having or doing. If you have the time I would appreciate your writing it up, setting it forth as a recommendation or an argument for our consideration.' "

"How does your system work? Has it increased the interest—tell me about your results," asked The Man Who Saw that his informent was a psychologist as well as an engineer.

"Well," said the thinker, "it worked well for my showing and it helped the boys. Two of them recently left me to do really big things on their own hook. The P. & Q. is after another one and I am afraid I shall lose him, as I can't very well see how he can turn it down."

New Devices Among the Exhibits

Pyrometer for Locomotive Service

THE LOCOMOTIVE SUPERHEATER COMPANY, New York, is showing its model 496 pyrometer equipment which is of the electrical type. This instrument makes use of the thermo-couple principle, by means of which an electric current proportionate to the difference in temperature between the hot and cold junctures of the couple is generated.

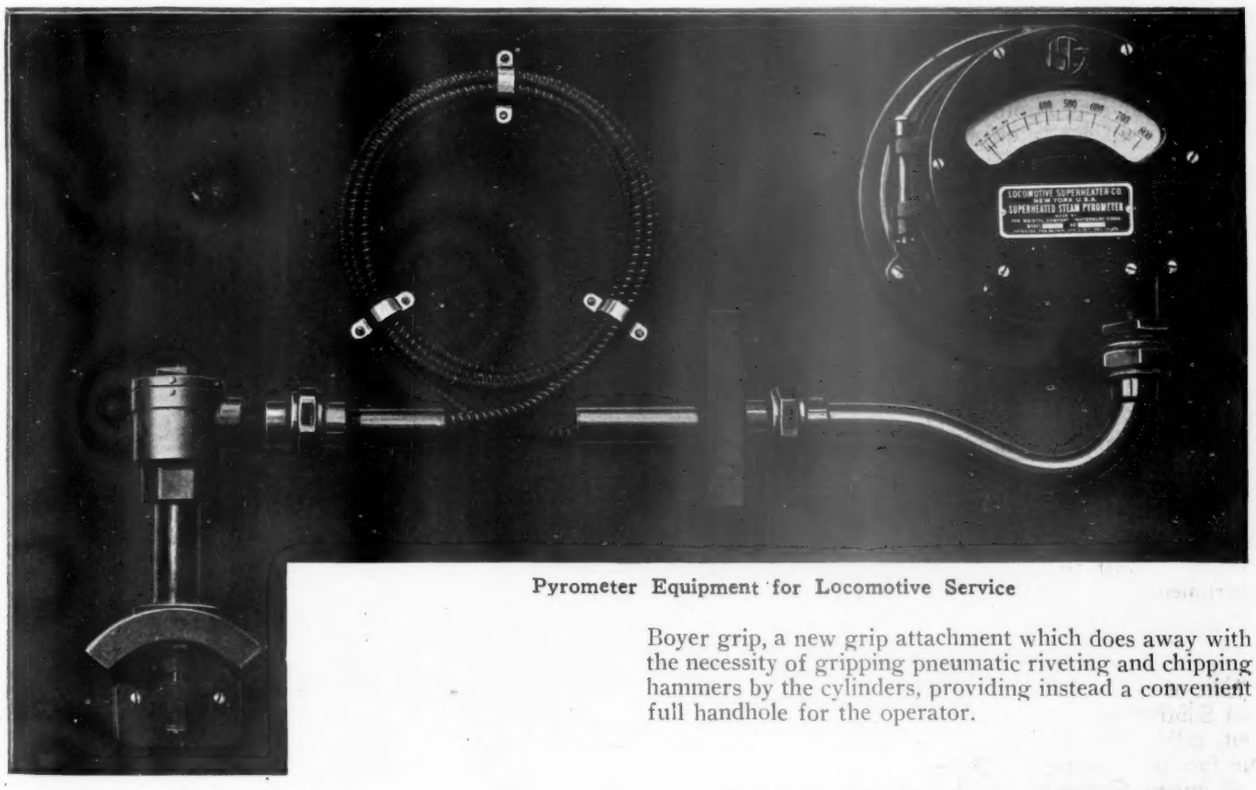
The indicator itself contains a millivolt-meter actuated by the current generated at the thermo-couple and moves a pointer on the dial indicating the actual temperature of the steam. The pyrometer equipment for each locomotive consists of three parts; a steam fixture (containing the hot junction of the thermo-couple), which screws into the steam pipe or steam chest of the engine; an indicator, which is placed in the cab, and a cable connecting the fixture to the indicator. The cold junction of the variations in the atmospheric temperature are automatically compensated for. The hot junction of the thermo-couple is directly exposed to the flow of superheated steam and the slightest variation in the steam temperature immediately affects the current generated, showing this change instantaneously upon the dial in the cab.

The entire equipment has been completely adapted to locomotive conditions and has been found valuable in checking operating and maintenance conditions, as well as proving a substantial aid in making adjustments and drafting locomotives.

This apparatus provides a constant check on the performance of the engine. If the water is too high in the boiler or the fire is not properly kept, or if any other condition affecting the steaming qualities of locomotives should arise, it is at once indicated by the pyrometer.

Advances in Air Drill Design

THE Little Giant air drills displayed this year by the Chicago Pneumatic Tool Company, Chicago, contain several new features of interest to users of pneumatic tools. One of the important recent developments is a new form of toggle and piston construction, including a replaceable crank-pin bearing and a one-piece connecting rod by means of which all joints, eye holes and toggle nuts are eliminated. The company is also displaying a new corner drill made in both reversible and non-reversible types. Another innovation is the Boyer grip, a new grip attachment which does away with the necessity of gripping pneumatic riveting and chipping hammers by the cylinders, providing instead a convenient full handhole for the operator.



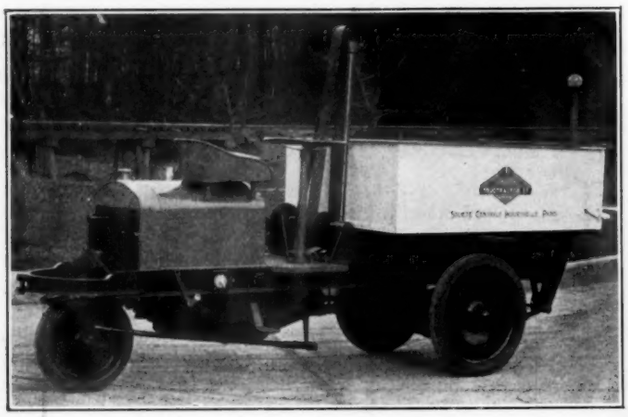
Pyrometer Equipment for Locomotive Service

Universal Air Hose Coupling

THE INDEPENDNENT PNEUMATIC TOOL CO., Chicago, is exhibiting an improved universal hose coupling. The coupling ends are absolutely interchangeable; consequently all confusion in ordering is eliminated and only the size required need be specified. Once connected the coupling cannot open when not intended, yet it can be uncoupled instantly by a pull on the sliding sleeves. The gasket cannot blow out, as it is protected from the flow of air by a protruding seat and the tapered back holds it securely in place.

The Clark Tructractor

ONE OF THE LATEST DEVELOPMENTS in industrial tractors is the Clark Tructractor, exhibited by the Liberty Steel Products Company of Chicago, who are the exclusive representatives for the railroad trade. The general design of this vehicle indicates a powerful and, at the same time, a flexible machine. It is constructed in a most substantial manner with a steel frame



Clark Tructractor with Dump Body

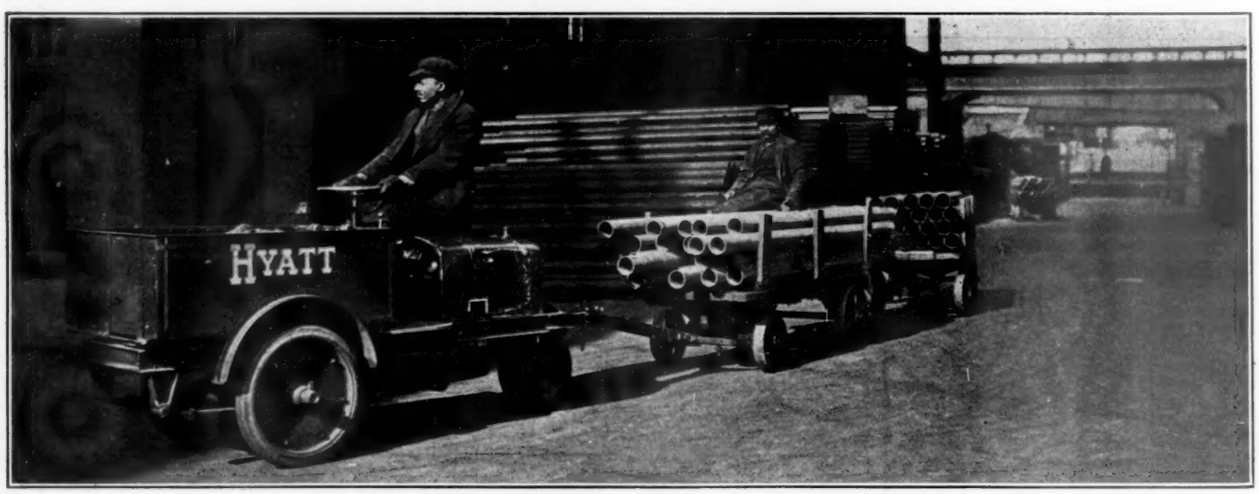
carried on two driving and one trailing wheel. The load carrying body is of sheet steel substantially braced with angle iron. The engine is mounted on the rear end of the frame. It is a four-cylinder 25 horsepower automobile type, with a differential gear acting on the forward axle, and will furnish sufficient power to propel the vehicle over rough roads or floors with a maximum tractive effort and enables it to haul heavy loads easily. The driver's seat is located directly over the engine hood.

Its carrying capacity is 1½ tons and with the dump body and its ability to make sharp turns, due to the wheel arrangement, it has proved very useful in congested places, such as foundry yards or shops, for the carrying in of sand or other material and the removal from the foundry of castings or refuse. The Tructractor is furnished either with the plain load carrier body without any dumping facilities, or with the dump body.

A clevis is provided at the rear end of the frame so that other trucks may be attached and the tractor used in a hauling capacity. The over-all dimensions of this machine, with a one-yard dump body, are 125 in. by 46 in., and the truck wheel base is 84 in. The tractor will develop a speed ranging from one-quarter mile an hour to 15 miles an hour. In a recent test this machine was driven a distance of 143 miles over country roads in a single day and it has given remarkable service in shifting loaded freight cars without any injury to its structure. The clearance above floor level is 9½ in., which enables it to move over rough foundry floors, factory yards or bad roads, and because of its low center of gravity it can be successfully used under almost any conditions.

The steering gear acting on the single trailing wheel and the driving mechanism are substantially that of the automobile. The axles are equipped with frictionless bearings and the wheels with rubber tires. The load carrying end is supported on semi-elliptic springs, which enable the machine to travel over rough roads with no undue strain on the body or machinery.

The Dump Body in Operation

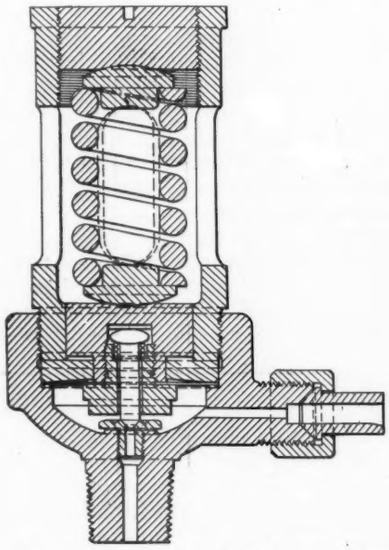


The Tructractor Used for Hauling

The steering gear acting on the single turning wheel sumption of three gallons of gasoline a day, and because of its unusually strong construction it should prove a most efficient and economical tractor for industrial purposes. The Tructractor is demonstrated each day, on the pier beside Convention Hall, between the hours of one and three o'clock.

Lubrication of Valves and Cylinders

IN 1911, THE EVOLUTION of the force feed lubricator for cylinders and valves of locomotives had progressed so little beyond the experimental stage that the Master Mechanics' Association's committee, which had been appointed to report on the comparative progress of lubrication of locomotive cylinders, summed up its findings in favor of the hydrostatic libricator as against the early



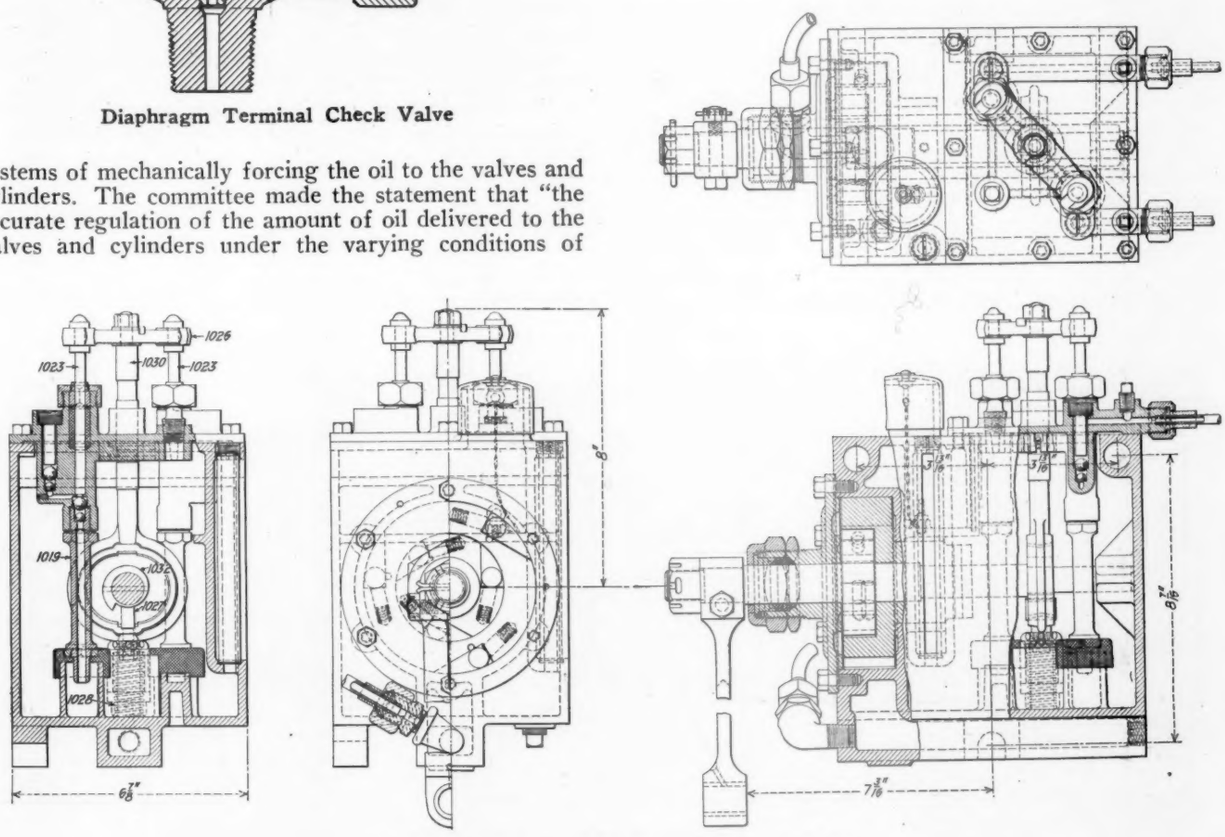
Diaphragm Terminal Check Valve

systems of mechanically forcing the oil to the valves and cylinders. The committee made the statement that "the accurate regulation of the amount of oil delivered to the valves and cylinders under the varying conditions of service performance by the locomotive at different speeds and points of cut-off" was only achieved by the hydrostatic lubricator.

Interesting evidence of what has been accomplished in eight years in the development of force feed lubrication, which successfully overcomes the objection cited above is afforded in the following description of the Schlack's system which is used in the force feed lubricator made by the Locomotive Lubricator Company, Chicago. The lubricator is mounted on a vertical flat plate, which is bolted to the head of the valve chest. The mounting of the apparatus is illustrated in one of the drawings; it will be seen that the mechanism is well out of harm's way, is easily accessible for filling and attention, and the installation as a whole presents an impression of compactness. The secret of the pump's efficiency lies in the variable control of its drive.

The pumping arm is driven from an extension on the combination lever of the valve gear. The distance between the radius rod connection and the center of the pump drive connection equals the distance between the valve stem connection and the radius rod connection, which insures a movement of the lubricator lever at all different cut-offs equal to the valve travel. The length of the lubricator lever, together with the valve travel, determines the amount of oil that is delivered into the steam at every revolution of the drivers. The formula by which the length of the lubricator lever is determined includes the valve travel at the normal running cut-off, multiplied by a constant of 2,500, divided by the diameter of the cylinder times the length of the piston stroke. This results in the injection of oil into the steam in proportion to the area of the cylinder walls to be lubricated.

In the 1919 model oil is delivered into the steam at every revolution of the drivers through the action of one pump in each oil pipe line, details of which are shown in one of the drawings. The wedge cam No. 1032 presses the stroke shaft 1030 and its bearing 1027 downward until it passes the lowest point on the cam, after which the spring 1028 carries the stroke shaft 1030 up quickly. The two plungers, 1023, one for each oil pipe



1919 Model, Locomotive Force Feed Lubricator

line, are connected to the stroke shaft 1030 by means of the cross head 1026 and on the quick upward stroke of the plunger, oil from the reservoir is sucked through pipe 1019 into the plunger chamber and forced out into the oil pipe by the successive downward movement of the pump plungers.

The lower end of the suction pipe is considerably below the top of the oil well and is covered by a very fine screen, which laps the upper part of the well about hanf an inch. Any light foreign matter in the oil will float on top; that which is heavier sinks to the bottom. The clean oil goes directly through the small meshed, so-called umbrella; should the screened umbrella be stopped up, it will pass between the larger diameter of the umbrella and the well, the combination of which makes extremely rare the chances of any foreign matter entering and affecting the pumping system.

The cam 1032 is revolved by means of a lever connecting through a friction ratchet. The pump mechanism is so designed that it delivers practically the same amount of oil at 140 degrees of temperature that it does at 265 degrees. Steam is delivered to the lubricator through a copper pipe tapped from the fountain and running under the lagging and against the boiler. The drain from the lubricator can be passed either directly into the exhaust channel in the locomotive saddle or to the air pump exhaust pipe.

When the locomotive is standing in the roundhouse, with very little radiation affecting the temperature of the lubricator, the steam in the lubricator heating chamber is under less than 2 pound pressure, keeping the oil at a temperature of less than 200 degrees. When the engine is running and the radiation of the lubricator reservoir is increased, the back pressure in the cylinder exhaust channel increases the pressure of the steam in the lubricator heating chamber, thus automatically increasing the temperature of the heating medium when required. The diaphram terminal check valve indicated by 1084 in the drawing of the front view of the application is connected with the steam pipe and maintains a constant oil pipe pressure, irrespective of the fluctuating steam pipe pressure, so that for every drop that the pump injects into the steam pipe, an equal size drop is simultaneously injected into the steam.

Trap Door Plate

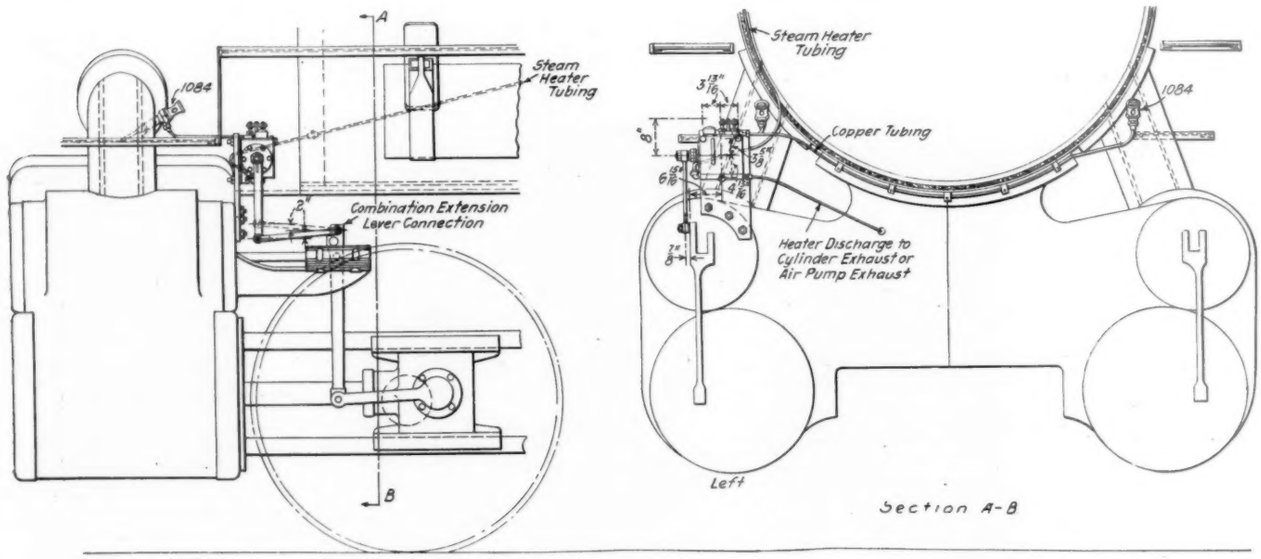
A TRAP DOOR PLATE which combines features of unusual interest is being shown in space C on the porch at the left of the main entrance to the pier. It is a new idea, which dispenses with much of the weight of older types of trap doors and is said to overcome the sticking tendencies of the latter.

The trap door plate is made of one-piece steel, No. 10 gage, with reinforcing ribs pressed in it on the under side, and turned over the edges, providing maximum strength and rigidity with minimum weight. Its weight is claimed to be approximately two-thirds that of other designs for the same area and rigidity.

The threshold is of one-piece steel beaded tread, securely riveted to the outside edge of the trap door plate and sufficiently strong to preclude possibility of buckling, through the pinching action of the buffer wings on the train when rounding curves.

The construction of the trap door plate makes it ideally adapted for the application of composition to replace rubber matting. Expanded metal is welded to the plate to provide the proper bond. Rib depressions permit material to work in under expanded metal, increasing the bonding action.

The lifting device proper consists of a specially designed spring and adjusting plug and worm. The spring is ¼ in. by 1 in. cross section high carbon spring steel, carefully tempered, wound helically, with coils approximately ¼ in. apart. This provides a winding action, also a very low fibre stress, and, therefore, long life, with the least possibility of breaking in service, and upon release of the trap door insures its rising with a slow, smooth action, thus eliminating customary banging. For a spring of this type a very fine adjustment is required. This is obtained by means of an adjusting plug and worm arrangement. The spring is anchored in a slot in the plug, which has gear teeth hobbed in it, and which meshes with the adjusting worm seated in the bracket. By turning the worm and thereby the plug a fine initial tension is placed upon the spring, this tension depending upon the size and weight of the trap door. With this arrangement any required adjustment, no matter how fine, is obtainable. Permanent adjustment is secured by means of a



Typical Application of the Schlack's System of Locomotive Force Feed Lubrication

locking washer which fits over the square shank of the worm and is locked on by means of a cotter pin. The lifting device is encased in a pressed steel housing of No. 13 gage material and consists of few parts of simple construction. The entire device is fitted directly to the trap door plate itself, thus facilitating repairs, whenever necessary.

This trap door is exhibited by the Tuco Products Corporation, New York.

Automatic Drifting Valve

THE LEWIS VALVE COMPANY, New York City, is exhibiting a mechanically operated automatic drifting valve. This valve is connected to the valve gear as shown in Fig. 1. In its operation when the locomotive is running, link *3*, Fig. 1, swings lever *4* to alternately open the compressed air governor valves *1* and *2*, Fig. 2. When valve *1* is open compressed aid is supplied from the air reservoir through pipe *6* to the compressed

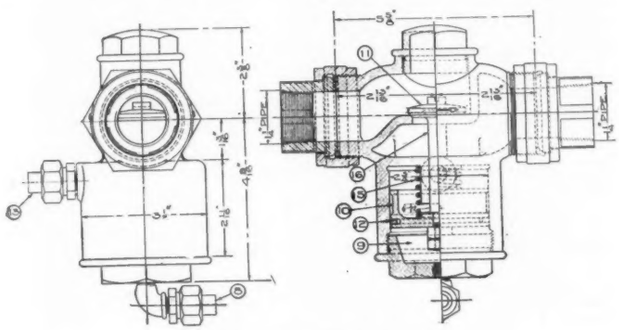


Fig. 3—Steam Governor

air governor chamber *7*, Fig. 2. When valve *1* closes, valve *2* opens, and the compressed air in chamber *7* expands into pipe *8* leading to the steam governor. When the locomotive is running above a predetermined speed compressed air will be intermittently supplied in sufficient volume to the steam governor cylinder *9*, Fig. 3, to raise piston *10* and valve *11* and retain valve *11* open

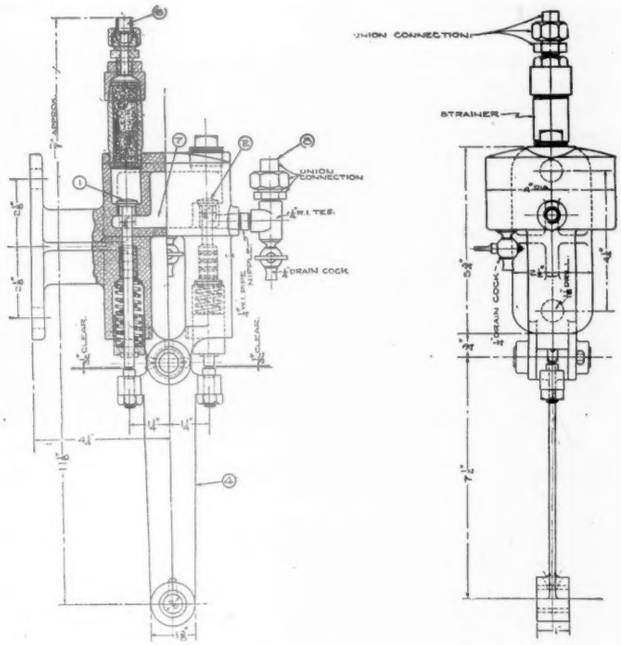


Fig. 2.—Compressed Air Governor

for the passage of steam from the boiler through pipe *14*, Fig. 1, to the locomotive cylinders.

When coming to a stop valves *1* and *2* will not open rapidly enough to supply compressed air in sufficient volume to retain valve *11* open and the compressed air in pipe *8* and cylinder *9* will escape through the steam governor packing ring *12* and pipe *13* to the atmosphere. Valve *11* will be seated by spring *15* together with the

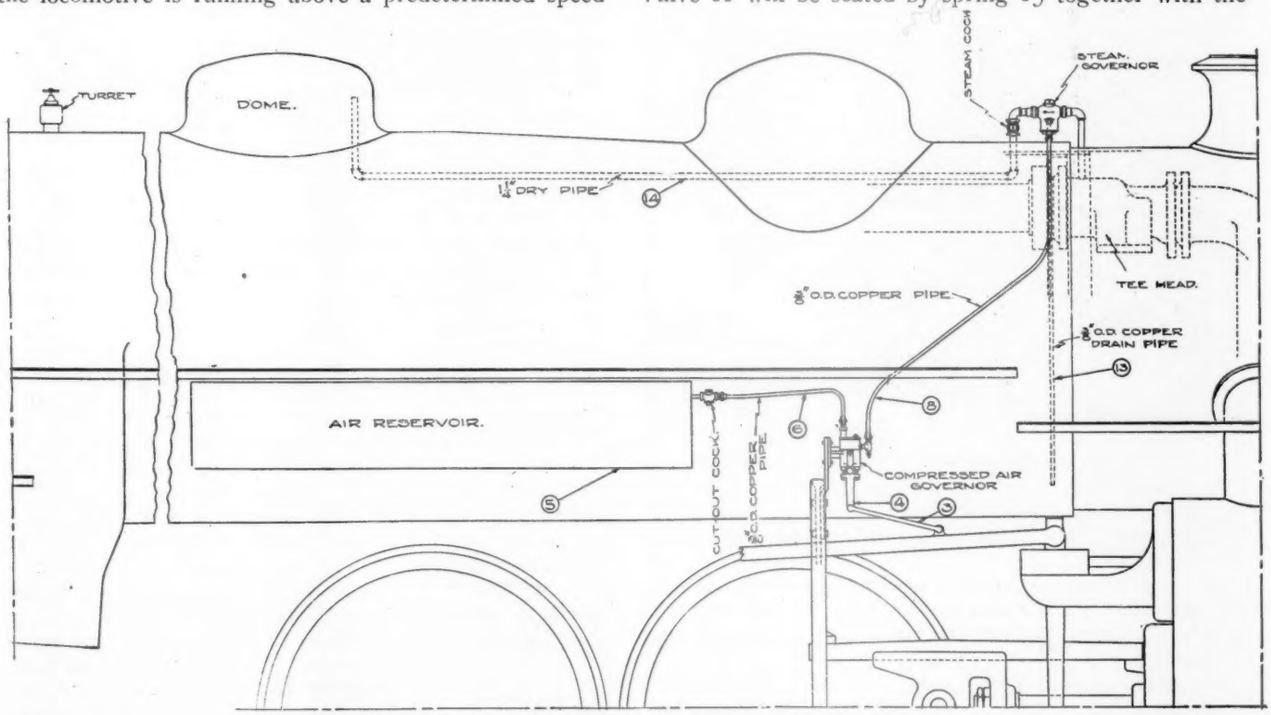


Fig. 1.—Application of the Lewis Automatic Drifting Valve

action of the steam on the upper end of the valve stem *16* and the supply of steam to the locomotive cylinders will be cut off a short interval before the locomotive comes to a stop, and the locomotive will stop with no steam remaining in its cylinders.

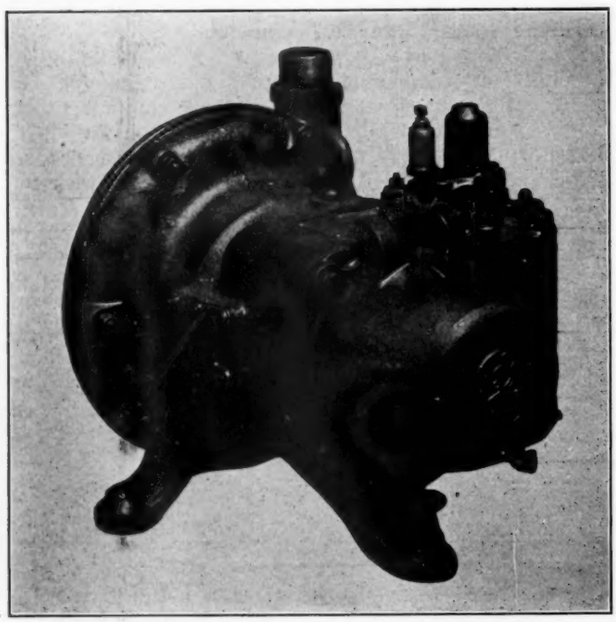
The packing used on the valve stems of the compressed air governor contains a permanent lubricant and oil holes are also provided on lever *4*, Fig. 2. No other lubrication is necessary.

Locomotives equipped with this drifting valve are in service between Richmond, Va., and Washington, D. C., on the Richmond-Washington Line, the Richmond, Fredericksburg & Potomac and the Washington Southern Railroad.

Turbine Headlight Set for Steam Locomotives

TO MEET THE REQUIREMENTS of steam locomotive headlight service, the General Electric Company, Schenectady, N. Y., has placed on the market a turbine generator set known as type CY-32B, especially designed to supply power for the headlight and cab lights. This set consists of a single stage Curtis turbine direct-connected to a compound wound generator governed on the steam end by a self-contained pressure regulating valve, and controlled electrically by a stationary magnetic brake coil and rotating copper disk which maintains practically constant voltage under different loads.

The machine is made in two sizes, 175 watt, 6½ volt, and 500 watt, 33 volt, for operation on boiler pressures varying between 125 and 225 lb. per sq. in. It is composed essentially of one metal casting equipped with three substantial feet. This casting embodies the generator frame, regulating brake coil chamber and turbine casting. The generator shield carries one of the ball bearings and the brush holders, and the exhaust head carries the other ball bearing.



Turbine and Generator Complete Ready for Mounting

The rotating part is composed of a shaft upon which is mounted the armature and bucket wheel, and to the bucket wheel is riveted a copper disk by means of which the load regulation is obtained. Cast integral with the main frame is a steam separator upon which is mounted the pressure reducing valve and pop relief valve.

The steam pressure at the turbine is maintained constant by the action of a hollow valve, steam working against the pressure of a spring, the section of the stem immediately below the ports being tapered. The tension of the spring is adjusted by the addition of thin washers, so that when the boiler pressure does not exceed 125 lb. the stem remains in its lowest position and no throttling of the steam takes place. When the boiler pressure exceeds 125 lbs. the stem is forced up and the tapered portion throttles the steam flowing out. The upward movement of this stem at all boiler pressures above 125 lb. is just sufficient to maintain constant steam pressure at the ports in the valve bushing.

The magnetic brake has no moving parts except the copper disk which is riveted to the bucket wheel and rotates in the air gap around the pole faces. The brake winding consists of a series and a shunt coil so proportioned that at full load the series coil neutralizes the magnetic effect of the shunt coil. Consequently no drag is produced on the rotating copper disk. When either the headlight or cab lamps are turned off, thereby reducing the current through the series winding, the field set up by the shunt winding is not entirely neutralized by the series field and produces eddy currents in the copper disk which results in a sufficient drag to hold down the speed of the rotor, thereby preventing over-voltage. The machine will run at its highest speed, 3,600 r. p. m., at full load, and any other condition produces a lower speed, unless an open circuit occurs between the brushes and brake windings. In this case, of course, no voltage is generated and the speed increases to approximately 5,000 r. p. m., a speed which the machine is made to withstand, however. This braking effect prevents burnt-out generator coils, for if an overload or short circuit occurs, the flux from the series coil overbalances the flux of the shunt coil, thereby producing a drag on the copper disk which is proportional to the amount of the overload. While the full-speed current of the machine is 15.2 amperes, and the speed 3,600 r. p. m., the short circuit current is about 12.8 amperes and the short circuit speed approximately 800 r. p. m. This form of governing is, therefore, not only simple, but it is also of value as a protection against burned-out windings. There are no moving regulator parts to become worn.

Railroad standards have been followed in the mechanical design. Only two sizes of cap screws and one size of nut are used, both sizes of cap screws being hexagon headed and slotted, so that if necessary the machine may be completely disassembled with the aid of an ordinary wrench and screw driver.

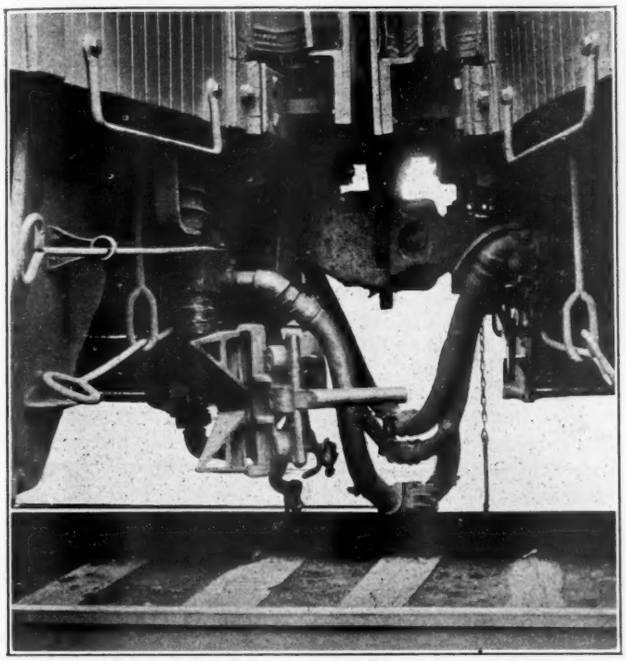
Storage Battery Cars

STORAGE BATTERY CARS constructed according to M. C. B. standards and having the car body and its appliances of steel with the exception of doors and inside fittings, are exhibited and demonstrated by the Railway Storage Battery Car Company, New York. Motive power is supplied to the wheels through gears by four 250-volt direct current motors, and current is supplied by these motors by Edison storage batteries. These cars were described in detail in the April 19, 1919, issue of the *Railway Age*. One of these cars is making exhibition runs between Atlantic City and Ocean City, leaving Virginia avenue and the boardwalk at 10.00 A. M. and 3.00 P. M. The running time is 50 minutes for the round trip.

The Union Automatic Train Line Connector

AN AUTOMATIC CONNECTOR for steam, signal and air brake train lines has been developed by the Union Connector Company, St. Louis, Mo., and is on exhibition. This connector is of the side port type, the gaskets registering in a plane making an angle of about one in seven with the center line of the car.

The connector is attached to any standard drawbar without welding or removing the couplers, by the use of attachments designed to meet the requirements of each application. Where the conditions permit, however, a lug may be welded to the drawbar to carry the connector. When new couplers are to be fitted with the equipment the lugs may be cast integral with the couplers. No

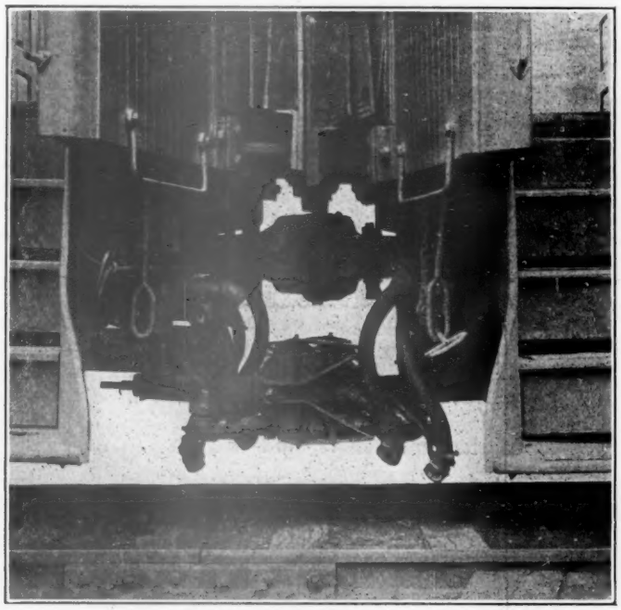


The Coupler Disconnected and Swung Aside for Interchange with Unequipped Cars

change in the air or signal hose need be made, as hose of standard length are attached to the connector by means of the standard hose couplings. This takes care of the interchange feature without the use of special dummy couplings, as it is only necessary to uncouple the hose from the connector to prepare for interchange with unequipped cars. The steam hose is ordinarily replaced with a flexible pipe connection leading to the connector. This pipe is screwed into a specially designed three-way end valve with two outlets, in one of which the standard steam hose may be screwed for interchanging with unequipped cars.

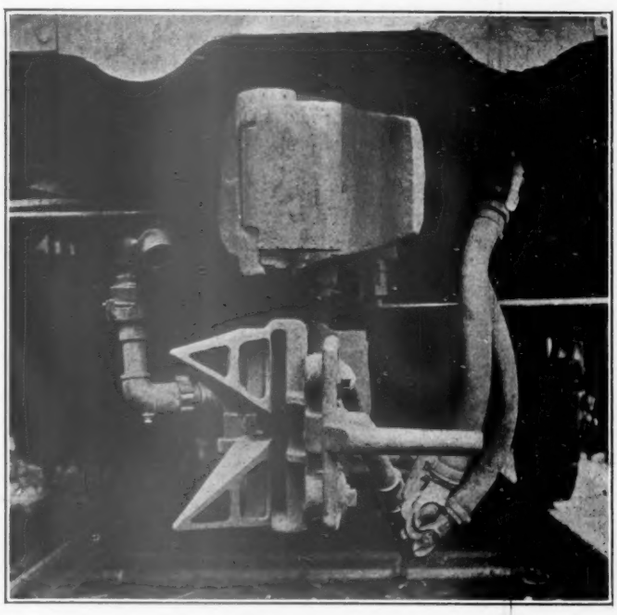
The connector has a gathering range of 11 in., both horizontally and vertically, which is about two inches more than the range of the car couplers. In registering horizontally the vertical tongue is gathered inside the points of the horns on the opposite head. Vertically, any variation in height is taken care of by the horizontally protruding pin, which is gathered between the upper and lower horns.

The connector is located with the center line of the brake pipe port about 17½ in. below the coupler, with the center of the gasket extending 2½ in. out from the inside face of the coupler knuckle. As two connectors come together the gaskets are registered and the connector springs compressed 2½ in. each, thus holding the heads locked together. Before coupling, the springs are designed to hold the connectors in a fairly rigid posi-



Union Automatic Train Line Connectors Coupled

tion, but when coupled the two connectors as a unit have universal freedom of movement, unhampered by the spring pressure. The side registering feature permits the use of light springs, the coupled compression of which amounts to only 250 lb. When interchanged with



End View of the Coupler

unequipped cars the connector is swung to one side, as shown in one of the illustrations, and locked.

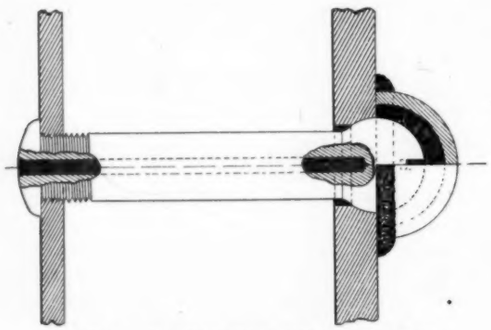
When coupled, the steam gaskets do not come in contact with each other, but remain loose in the heads. When steam pressure is admitted to the train line the steam forces the gaskets to close tightly against each

other. They are said to remain steam tight until condensation accumulates in the coupling, when it drains automatically without the escape of steam. The slight angle at which the gaskets register is designed to prevent any tendency for the gaskets to shear.

This connector has been developed as the result of a long period of service trials under a variety of conditions in which special attention has been given to the design of a device which will meet in a practical manner the requirements of interchange during the period when such connectors must frequently be used with unequipped cars.

New Designs of Flexible Staybolts

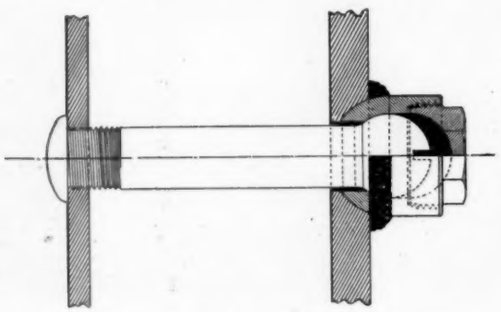
SEVERAL NEW DESIGNS of flexible staybolts, made feasible by the development of autogenous welding, are being exhibited by the Flannery Bolt Company, Pittsburgh, Pa. Electric welding is used to secure the caps and sleeves of flexible staybolts to the outer sheet for the purpose of doing away with the threaded sleeves and the tapping of the outer sheet, and in order to overcome



Hollow Flexible Bolt with Solid Cap

occasional troubles resulting from the leakage of sleeve threads. It also eliminates the uncertainties of the tooling operation in tapping the outer sheet to obtain perfectly tight installations of the sleeves in all instances.

The F. B. C. universal type of flexible staybolt contains a universal sleeves with inserted plug and gasket, that rests on a counterbored seat made in the outer plate at an angle corresponding with that of the staybolt. The round head Tate bolt has its bearing inside the sleeve,



Application of Universal Staybolt Sleeve

with sufficient clearance between the cap and the bolt head to obtain the necessary longitudinal movement under firebox expansion. The universal sleeve, when located on its counterbored seat on the plate surface, is held up tightly to the plate, and is then electric welded to the outer plate surface. Welding seals the connection tightly, thus providing a reinforcement that adds strength to the plate section where the sleeve is applied. The bolt is then inserted through the sleeve and screwed into the firebox sheet until the round head takes its bearing in the sleeve. It is then riveted up and the plug and gasket are inserted in the sleeve.

The F. B. C. plain type of flexible staybolt is made in two designs. One design provides for seating the round head Tate bolt directly on the outer surface of the wrapper sheet, in a counterbored bearing. A one-piece cap is placed over the bolt head with ample clearance to allow for bolt movement, and is then welded to the outer plate. The closed cap used in this design necessarily demands a hollow staybolt and a drilled hollow Tate bolt is provided with a telltale hole extending from the riveted end of the staybolt to a point just beyond the round head, so that if a fracture should occur at any portion of the bolt beyond the round head it could be detected, provided it reached the telltale hole. The holes are cleaned out before inspections and tests. This design is very simple and no doubt will be found useful in certain types of firebox boilers. For locomotive boilers at the present time there is no ruling for inspection and test for a flexible bolt of this kind.

The other design provides for the use of a cylindrical housing with plug and gasket, welded onto the outer plate surface, covering the Tate staybolt, which is applied to the plate in the same manner as for the one-piece closed cap, thus allowing for the use of a solid bolt, and the removal of the plug in the housing for the periodical inspection and test of the staybolt.

At the Flannery Bolt Company's exhibit several models of the F. B. C. flexible staybolts are exhibited, showing the welded sections and separate parts, as well as the drilled Tate bolts, which can be used in the regular Tate flexible staybolt assemblages whenever it is thought advantageous.

Hvid Oil Burning Engine

THE HVID TYPE OIL BURNING ENGINE is being exhibited by Manning, Maxwell & Moore, Inc., New York. This engine operates with any liquid fuel and the fuel is not compressed before being fed to the engine. The small engines of this type are said to develop about 12 brake hp. hours per gallon of fuel oil and the larger engines 16 brake hp. hours per gallon. The small engines are started by cranking, while the larger ones are equipped with auxiliary air or engine starters. The fuel oil is completely burned so that there is no trouble with a carbon deposit; the exhaust is clean because of the high temperature in the cylinder at the time of combustion.

Briefly, the operation of the engine is as follows: During the suction stroke of the piston air is admitted to the cylinder through an intake valve. Simultaneously liquid fuel for one charge is admitted into the fuel cup by gravity flow. A small amount of air also enters the fuel cup, which is always open into the cylinder through small holes in the fuel cup. On the compression stroke of the piston the air in the cylinder is compressed to such a degree that it is heated to the point of ignition of the fuel, which is thus vaporized and ignited, creating a partial explosion in the fuel cup. The fuel is thus heated and then atomized through holes in the fuel cup into the cylinder, where it is completely burned. The pressure generated forces the piston through a power stroke. On the following exhaust stroke the piston expels the burned gases through the exhaust valve and the cycle is repeated.

Removing Old Paint

REMOVING THE OLD PAINT from steel passenger and freight cars, locomotive tanks, structural steel, trucks, underframes, locomotive jackets, etc., is often as much of a problem as the repainting job itself; while methods of quick applications of new coats of paint have been brought to a high point of efficiency, the

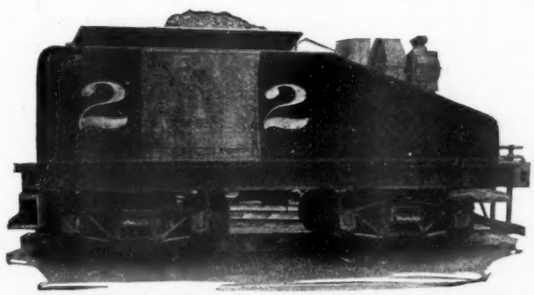
Removing Old Paint with Solvit Compound

various procedures incident to the removal of old paint have offered room for improvement.

A new paint dissolving solution called Solvit has been recently brought out by Mudge & Co., Chicago. It is said to be non-inflammable, easily applied to flat surfaces and being of the proper consistency, will adhere easily to any vertical surface. One of the greatest difficulties

Before Applying Solvit Compound

met with in the use of many paint removers is the tendency of the remover to dry within a short time after it has been applied; it is necessary constantly to spray such removers with water. This of course means additional time, labor and expense. Solvit will remain moist for from 10 to 24 hours, and when once applied further attention is unnecessary until the paint is in condition so that it can readily be scraped or washed off. After being applied it is allowed to remain from one-half to six or



Immediately After Applying Solvit Compound

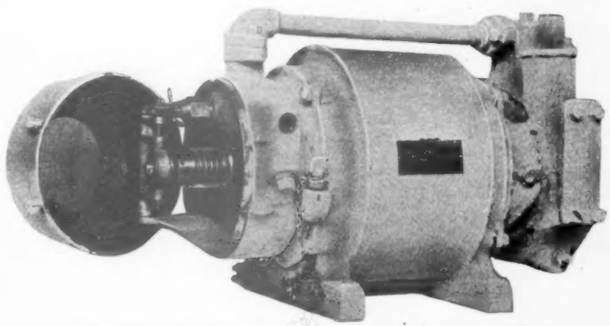
seven hours, depending entirely on the thickness of the paint to be removed. After it has thoroughly penetrated the paint, the latter may be easily removed by using hose and water or a scraper knife, leaving a clean surface for refinishing.

This compound is recommended for use on metal objects only, with the exception of brass and aluminum. It is not recommended for the removal of paint and varnish from wooden surfaces. The liquid can also be used for cleaning and renovating interior walls, hoppers, dining car kitchens, etc.

The photographs show one of the methods of the application of Solvit in removing the paint from a switch engine tender. The liquid may be applied with a brush, but for the purpose of speed and economy the method shown in the second illustration is recommended.

Alternating Current Headlight Generator

THE GOULD COUPLER COMPANY, New York, is placing on the market a new 500-watt, 32-volt turbo-generator for locomotive headlights. The generator is designed on an entirely different principle from any of the headlight equipments that have heretofore been marketed. It is an alternating current device and combines a number of advantages that are inherent with this tipe



The Open Cover Shows the Absence of Brushes and Commutator

of machine. There are no rotating wires, no commutator, no brush holders or brushes. The rotating element revolves in ball bearings.

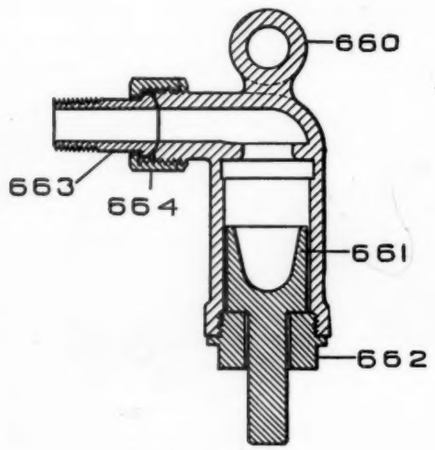
More electric headlight trouble and headlight failures can be attributed to commutator and brush trouble than to any other source, and in view of the fact that there are a great number of locomotives which must soon be equipped with electric headlights, the generator should receive most critical attention.

Pivoted Type D Passenger Coupler

THE MCCONWAY AND TORLEY COMPANY, Pittsburgh, Pa., is showing an adaptation of the new standard D coupler with pivoted head for use on passenger cars. The coupler head and shank are separate members and are connected in pivotal fashion by means of a 2¾ inch pin. In the shank are mounted devices, simple, compact and readily accessible, for centering the shank on the car and for holding the coupler head normally in alignment with the shank. The coupler head and all contained parts are "standard D," the rear portion of the head being designed properly to co-operate with the shank and centering device, the whole forming an equipment having the flexibility recognized as being so essential for passenger car service and providing for the use of standard D parts.

Sellers Injector Indicator

THE USUAL FORM of "tell-tale" for non-lifting injectors warns the engineer by discharging a jet of steam into the cab when the injector blows back. The indicator illustrated herewith, and which is exhibited by William Sellers & Co., Inc., not only performs the function of tell-tale without discharge of steam into the cab, but, in addition, advises the engineer if the injector is wasting water at the overflow and enables the operator to adjust the feed valve to the actual maximum or minimum capacities of the injectors. Its action depends upon the well-known principle that when feeding without waste there is always a partial vacuum within the overflow chamber of an injector of the gravity overflow type. This vacuum is utilized to raise the loosely fitting piston to its upper seat, causing the projecting plug to disappear from view. If, for any cause, the injector starts to waste, the vacuum within the overflow chamber is broken, the piston drops to the lower end of its stroke and exposes the projecting plug. The operator is thus warned and will partially close the lazy cock, stopping the waste.



Injector Indicator

If there is an interruption of the water or steam supply, and the injector "flies off," the piston will instantly drop to its lower seat, preventing outflow of steam; the engineer will be again warned of the danger.

A further advantage of this form of indicator is that it enables the engineer or fireman to obtain the actual minimum capacity and adjust the feed to the varying needs of the boiler. Most operators do not regulate the water supply closely, fearing that the injector may break off without warning, or waste at the overflow. The indicator is so sensitive to conditions in the overflow chamber that the exact minimum can be obtained by regulating the lazy cock until the end of the piston appears, due to the loss of the vacuum in the overflow chamber; a very slight opening of the lazy cock will cause the piston to rise and the exact minimum is obtained, with resulting economy of fuel.

Further, the application of the indicator will reduce the tendency of the engineer to close the heater valve, which prevents the injector from restarting automatically, so that this form of indicator materially increases the safety of the boiler feeding system. The Sellers indicator makes the non-lifting injector as safe and certain to operate by night or day as an open overflow lifting injector.

It is said to be applicable to the Sellers, Nathan WF, Nathan Simplex, Chicago, and other forms of non-lifting injectors using an overflow chamber containing the combining tube and closed against the atmosphere by a gravity overflow valve.

Chrobaltic High Speed Cutters

MILLING MACHINE CUTTERS cast from high speed steel are one of the new products developed to meet war-time demands, which are being exhibited at the convention. The demand for high speed steel for munitions work taxed the available supply of tungsten, and to meet the emergency the Chrobaltic Tool Company, Chicago, developed a high speed alloy steel made without tungsten, known as Chrobaltic alloy. This new product not only makes the use of tungsten unnecessary, but also saves material and high priced labor, as it can be cast into the most intricate shapes.

Chrobaltic alloy has been used in the manufacture of milling cutters, blanking, drawing and forming dies and hot and cold trimmers. It offers remarkable resistence to abrasion and is therefore particularly adapted for gages and similar instruments. The cutter or tool is cast to practically the finished form, leaving from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. for finish, and the tools are machined to within a narrow tolerance before heat treating. Final finish, however, is attained by grinding as in the case of regular high speed steel cutters. These new high speed steel castings have the appearance of good smooth forgings. They are practically non-rusting and acid-resisting, and their grain is uniform and dense. The heat resisting qualities of the new alloy are high and it does not scale in the fire, thus adapting it to milling cutters having very thin cutting edges. The cast tools are furnished in the finished state ready for use, or they are supplied in annealed form to the customer who machines them to accurate dimensions and hardens them for use. They may be hardened in oil or air, and the process of annealing and rehardening may be repeated many times without losing any of the properties of the steel.

Annealing is effected by heating to 1,832 deg. F. in closed muffle furnaces and allowing the part to cool slowly. However, very rapid annealing may be effected by heating slowly to 1,202 deg. F. in a muffle furnace or in a blacksmith's fire, allowing the temperature to fall there to a black heat, and afterward cooling naturally in still air or quenching in boiling water. After annealing, the casting should show about 38 scleroscope hardness. It can then be machined at the rate of 25 to 30 lineal ft. per minute.

To harden Chrobaltic cutters, they should be heated slowly in a hardening muffle furnace to 1,832 deg. F. to 1,877 deg. F. and held at this heat until the tools are thoroughly soaked. The heat is then allowed to drop about 20 to 50 deg., at which heat the cutter is withdrawn and quenched in oil. Good results may also be obtained by allowing the cutter to cool in still air until the red disappears and is invisible in the shade, then quenching in oil. The slight drop in temperature while the tool is still in the hardening furnace is important. On very large milling cutters, a blast or air current may be used to accelerate cooling before quenched in oil.

In comparing the cutting and wearing qualities of Chrobaltic alloy with those of tungsten high speed steel, there is practically no difference where the ordinary temperatures in service are involved, but in abrasive service, as in the machining of phosphor bronze, white metals, etc., as much as ten times the wear is obtainable from Chrobaltic cast cutters.

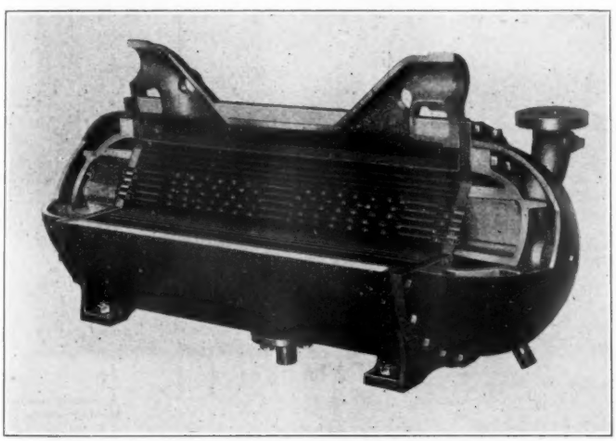
Type E Locomotive Feedwater Heater

ALTHOUGH THE TYPE *E* HEATER of the Locomotive Feed Water Heater Company, New York, has been in service over two years it has never before been seen at the convention. A half-size model is being shown embodying the corrugated agitator feature that is responsible for results beyond what was even hoped for.

This type is a development of the double tube or corrugated film type that was shown at the last convention. It was found that a higher heat transfer could be obtained by agitation of the water in the tubes. Metal agitator strips were therefore introduced in 5/8-in. brass tubes. The tubes are four feet or more in length between tube sheets and are arranged in groups so that the water makes the passage of four different lengths of tubes in going through the heater, giving it a travel of over 16 feet in the tubes.

Within each tube is a spirally corrugated agitator made of this brass stripping. These agitators have stops at one end which overlap and interlock and prevent the agitator from turning in the tube. The water in passing through the tube and around the agitator is constantly impinging against the inner surface of the tube. This results not only in the high transfer of heat for a given area, but also scours the inside of the tube and keeps it clean.

Heavy cast iron headers are bolted to the tube plates and are arranged with partitions which cause the water to flow through the four passages in succession. These headers are easily removable for inspection. One of the



Sectional View of the Type E Heater

tube plates is larger than the other and is arranged to be secured to the end of the cast iron body which encloses the whole nest of tubes. The smaller tube sheet is allowed to move freely in a longitudinal direction within the body and thus provides for the difference between the expansion of the brass tubes and the cast iron shell. This end of the shell is enclosed by a casing to prevent the escape of the exhaust steam around the floating header.

Feet for securing the heater to the locomotive frames are formed on the body and elbows are provided for connection with the pipes leading from the exhaust passages in the cylinder. A drain is provided at the bottom of the shell for clearing away the condensed steam. It will be noticed that there is a baffle plate at the top of the nest of tubes to prevent the impinging of the steam directly on the tubes, and a tube nest guard is placed at the bottom to prevent damage to the tubes when the nest may be removed for any purpose.

Inlet and outlet water connections are provided at one end of the heater, the arrangement being for a flanged pipe connection to allow the removal of the header without disturbing the pipe lines. A thick coating of asbestos lagging is placed around the body of the heater and this is covered with a sheet steel jacket.

A point of special interest in this heater is the form of joint used for the connection of the tubes and the tube sheets. This joint includes a groove in the tube sheet about midway between the two faces, and as the brass tube is rolled the metal is forced into this groove. Experience has shown that by employing this construction a leaky tube at its connection with the tube sheet is practically unknown.

A drain is provided at the inlet end of the heater which, when opened, will remove the water, not only from the heater but also from the pipe leading to the pump and the connection as far as the check valve at the boiler. Thus by opening the drain on the end of the heater all of the line between the pump and the boiler check valve is easily drained.

Connections are provided to receive the exhaust steam pipe from the boiler feed pump and also from the air pumps at the back of the elbows on the top of the heater body.

This design of heater has been developed after three years' practical experience in locomotive service and is the result of a most careful study of roundhouse and shop conditions as well as regular road service.

A boiler feed pump designed especially for this work, has been developed by the assistance of the Westinghouse Air Brake Company. This pump has operated under the most difficult conditions with a slip of not over four per cent and a steam consumption of not over 70 lb. per water horsepower at any point of the range of capacity. The pump will consume less than two per cent of the capacity of the boiler and the amount to be deducted from the theoretical saving of the feedwater heater is less than two per cent.

Between 65,000 and 70,000 lb., or from 7,800 to 8,400 gallons of water an hour can be handled by this pump at its maximum rate. A normal continued rate of 50,000 lb. or 6,000 gallons an hour is maintained with quiet action.

The steam end is essentially the standard 9½-in. locomotive air compressor of the Westinghouse Air Brake Company. All standard 9½-in. air pump parts for the steam end are used in the water pump. On the water end the effort made was to develop a rugged construction with every part easily accessible for inspection and of the simplest and strongest design.

Valve chambers containing the suction and discharge valves are located on either side of the water cylinder in order to get ample volume for the free passage of the water and at the same time keep the pump within clearance limits for attachment to the side of the locomotive. The valves are located in groups of five, each side containing two sets, one for suction valves and one for discharge valves. Each set of five valves is arranged in a separate removable deck which is held in place by a center bolt. The stops for the suction valves are part of the upper or discharge deck and the stops for the discharge valves are attached to the valve chamber cover.

By using this large number of valves in each deck it is possible to get the desired area of opening with a very small lift of the valve, which gives high efficiency and also results in greatly reduced maintenance cost. With the low lift the valves do not pound themselves and their seats, or start leaking nearly as soon as would valves of larger size. Bronze valves and valve seats are used

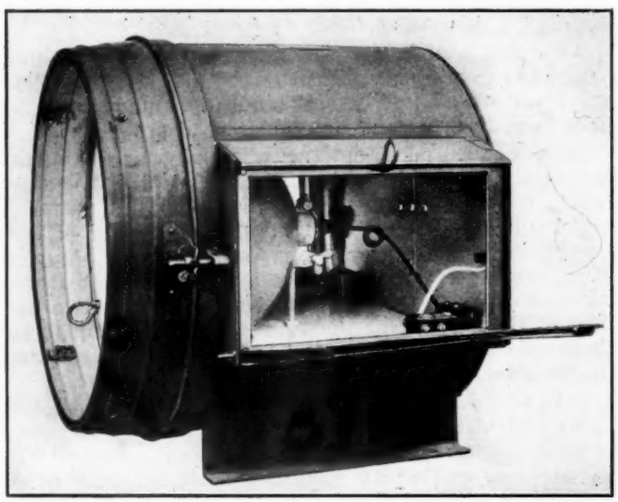
and over each is a light bronze spring insuring quick and positive action to each valve.

An accepted standard water packing is used on the water piston and the construction at this point is extremely simple. It incorporates a follower plate which carries an adjusting screw in the center for following down the packing, if necessary. Experience has shown that very little attention is required at this point. The packing should need renewing only at the shopping of the engine.

This pump has a fire hose connection at the bottom of the air chamber. Suitable provision is made for a careful draining of all parts of the pump in case the locomotive is to be laid up dead in cold weather.

Electric Headlight and Generator

THE SCHROEDER HEADLIGHT AND GENERATOR COMPANY, Evansville, Ind., has improved its equipment by the addition of several devices. Automatic disconnecting switches have been applied to the headlight so that the reflector and other internal parts in the head-



Headlight with Side Open, Showing Disconnecting Switches

light case may be removed without the necessity of disconnecting any wires. Another improvement in the headlight makes the interior of the headlight easily removable and at the same time holds it firmly in position under all conditions of vibration to which headlights are subjected.

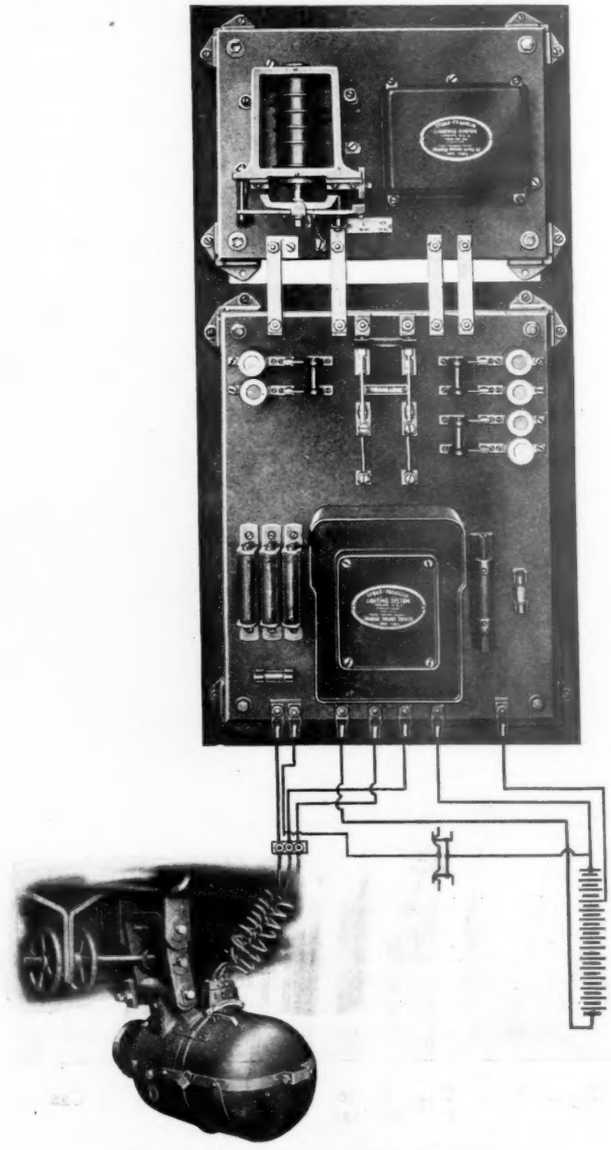
A piston valve, operated by the governor which controls the flow of steam and the speed of the turbine, has been added. The makers claim that this valve has done away entirely with the sticking of the valve caused by deposits of lime or other foreign substances common to localities where the water is bad.

Car Lighting Equipment

THE STONE FRNKLIN COMPANY, New York, has introduced a single battery system of car lighting, the operation of which is based on principles never before applied to car lighting equipment. It has been discovered that with constant output from the generator there is a certain relation between voltage and current delivered to the battery when gassing commences. When the charge reaches the gassing point the rate of charge is automatically reduced. In this way excessive gassing is prevented and the amount of flushing required is greatly reduced.

Lamp voltage regulation is obtained in the same manner as with the two-battery system, except that the regulating voltage is obtained from the one battery.

Four devices control the operation of the equipment. These are the constant watt generator output by speed control, the auto triplex switch, the reducer switch and a relay. The sequence of operations is quite simple. When the speed of the train is sufficient to bring the generator voltage up to the proper value the auto triplex switch connects the generator with the battery. Five contact fingers on this switch, without any adjustable springs, interpose properly proportioned lamp resistance for any supply voltage, and finally connect to the posi-



Panel, Generator and Connections

tive lighting circuit, a battery potential equal to the lamp voltage potential which is used for lamp voltage regulation.

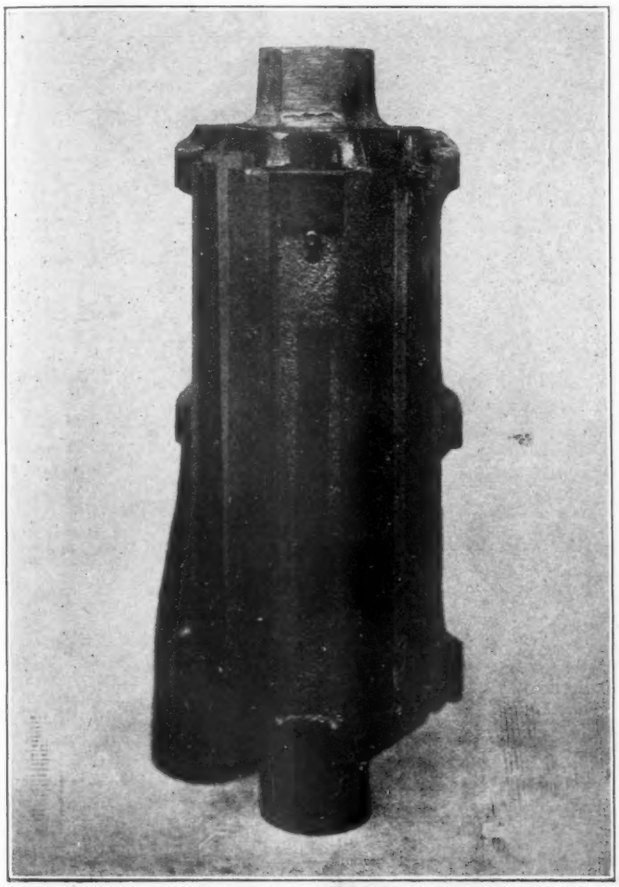
As the battery approaches the gassing point the voltage rises and the current falls off. When gassing commences the relative values of voltage and current are such as to cause the reducer switch to operate. This switch shunts

out a part of the generator current through a resistance thereby reducing the rate of charge of the battery. It also prepares the relay to operate at a predetermined battery voltage. After reduced the charge rate has been continued for a period of time, the relay disconnects the generator by opening the triplex switch when the battery voltage has increased to a certain predetermined value.

A change of adjustment of the reducer switch makes it possible to use either lead-acid or alkaline batteries with the same equipment. If two batteries are wanted for dining car or private car service they may be taken care of by the addition of a change-over switch.

Babcock Water Gage Protector

THE JOHNSON BRONZE COMPANY, New Castle, Pa., is exhibiting an improved design of the Babcock water gage protector, which is intended to improve materially the visibility of the water gage glass for observation with either natural or artificial light. The protector possesses all of the features formerly incorporated in the design, which include the heavy cast bronze body, the double observation glasses, each of 3/16-in. glass plate, and the outlet for steam, hot water and broken glass in the event of a broken gage glass.

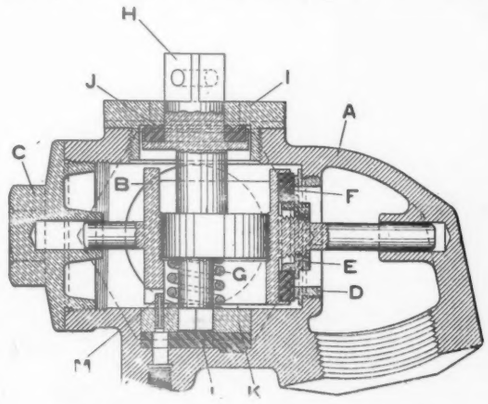


Babcock Water Gage Protector with a Slot in the Casing to Illuminate the Interior

The new feature consists of a narrow slot in the front of the protector, which, by admitting the light, either natural or artificial as the case may be, illuminates the gage glass in such a way as to clearly show the water level to the engineer and fireman on opposite sides of the cab. The photograph shows the front of the protector with the slot for admitting light in the casting behind the front window.

Packless Steam Heat End Valve

IN RELIEVING THE CONDENSATION at the rear end of passenger train heating lines, the general practice has been to open the end valve slightly. This, however, has not proved satisfactory, and many different devices have been designed to take care of this drip automatically All of these have been arranged to drain through the hose and have frequently caused freezing and decay of the hose. The Gold Car Heating & Lighting Company, New ,York, has recently developed a new end valve known as No. 1126, in which the drip is automatically relieved through the valve itself, thus eliminating the continual dripping through the hose. The valve is also of a packless design and will not leak around the stem.



Section Through the Center of Valve

In the sectional view of the valve it will be seen that it is of the piston type, similar to existing Gold end valves. A composition disk *F*, insuring a tight valve when it is closed, is mounted on the face of the piston. A composition disk *L* is located in the base of the valve and is held stationary in its position. The seat *K* is of metal and rotates against the composition disk *L*. The metal seat *K* also has a sliding motion on the base of spindle *H*, so that the pressure from spring *G* will force it to a positive contact with the composition disk *L*, thus insuring a positive seat. A hole in the seat *K* and the disk *L* is so located that when the valve is closed (Piston *B* being forced to the right by the cam on spindle *H*) the seat *K* will rotate to a position so that the holes are in line, thus allowing condensation to drip out. The spring *G* presses the spindle *H* upward firmly against the bonnet . With the disk *J* at this point a leak is practically impossible, thus doing away with the packing at this point.

A quarter turn fully opens or closes the valve, and it cannot be jarred from its set position by the vibration of the train, or be unseated by the steam pressure. The valve is substantially built, the body being of iron and the cam and spindle of brass cast in one piece. The spindle is short and of large diameter and should keep in perfect alinement for a long period. The distance from center of the train pipe to the top of the spindle is 2¾ in., and it will clear any adjacent apparatus.

The area of the passage in the valve is so large that it offers less resistance to the flow of steam than the train line itself. The seats of the valve are renewable and can be replaced without disconnecting any piping. In addi-

tion to relieving the hose of the effects of the continual drip incident to the condensation passing through the hose coupling, it is also a protection to the trainmen when uncoupling the hose, as the opening between the train line and the hose is tightly closed when the valve is shut.

Valve Gear for Standard Locomotives

IN SPITE OF THE ARMY of conscientious objectors to the so-called "monkey motion"—a term once sarcastically applied to all types of outside valve gears—and strong predictions from some "old timers" that "they would scrape it off on the corners of box cars as they pass," eccentrics and links seemed to disappear almost over night. In their places appeared the comparatively simple, accessible and more trustworthy steam distributing mechanism, deriving its motion from the crank pin and the crosshead. Evidence of continued thought and consideration for the betterment of the Baker valve gear in contending with the regularly increasing demands made upon it, is contained in the announcement by its manufacturers, the Pilliod Company, New York, of recent changes in its construction to comply with the requirements of the United States Government standard locomotives. For passenger engines, cast steel frames, vanadium cast steel bell cranks and drop forged reverse yokes, radius bars, connecting rods and other minor parts will henceforth be standard. On freight and switch engines all frames will be of cast steel. All principal gear parts will be of vanadium steel except the radius bar, which will be drop forged.

More than 800 of the Railroad Administration standard locomotives have been equipped with this valve gear.

Four-Wheel Drive Auto Truck

THROUGH THE COURTESY of the War Department the Four-Wheel Drive Auto Company, Clintonville, Wis., is exhibiting a three-ton, four-wheel driven truck, which is one of over 17,000 of these trucks used by the Allies and the United States Army during the war.

Four-Wheel Drive Ammunition Truck

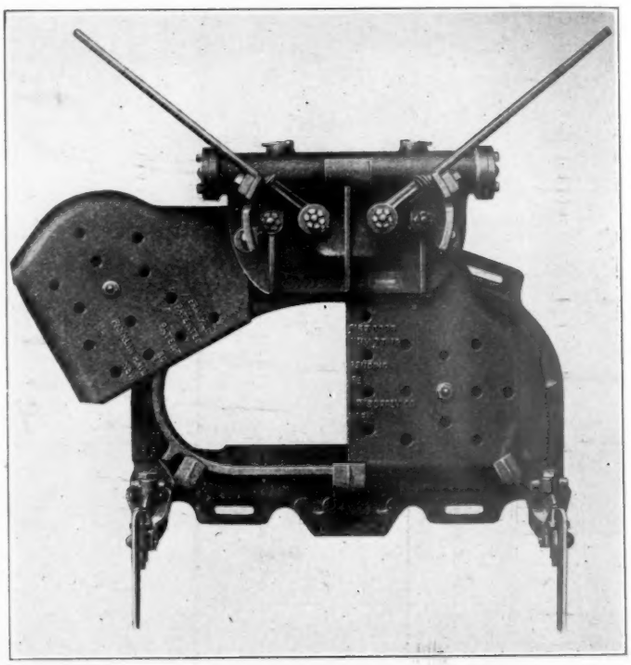
The artillery repair trucks which are included in the exhibit of U. S. Army ordnance, are also of the same type.

The feature of this truck is its high tractive power, made possible by the utilization of all four wheels for driving the truck. To effect uniform traction on all wheels the weight of the truck is also equally distributed and the same size tires are used all around. This truck is readily adapted to run on railway track by the substitution of flanged steel tires for the solid rubber tires ordinarily used. No change in gage is necessary in making this conversion.

Such an application has already been made on the Northwestern Pacific, where one of these trucks is handling two 40,000-lb. dump cars and two 60,000-lb. flat cars on a 1.2 per cent grade. This installation indicates the adaptability of the truck to railway contractors' work.

Double Butterfly Firedoor

A DOUBLE DOOR that provides for the independent operation of each firedoor has been developed by the Franklin Railway Supply Company, New York, and is known as the Franklin double No. 6 type. This door is used on openings from 20 in. to 36 in.; the latter is the widest so far made. Its use cuts down by one-half the amount of air entering the firebox opening, as it is used only when the opening of one side will admit a coal scoop.



Double Butterfly Door for Wide Fire Door Openings

The single operating cylinder contains two pistons that work in opposite directions, each operating one door by means of a link connection. The construction of the pistons and port valves and foot levers is the same as in the single operating Franklin No .8 door, one for the right hand and the other for left hand operation. This does away with the use of the gear in automatic operation. While this type of door still retains a gear, it is for hand operation only. The door is also arranged so that it can be opened by hand so as to uncover the entire opening to permit passing grate bars through the door frame. This arrangement of door is now being applied in place of the horizontal or vertical double doors to engines having a wide fire box and a large fire door opening.